

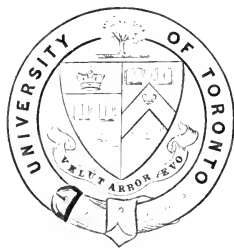
Intestinal Diseases of Infancy and Childhood.

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INTESTINAL DISEASES OF INFANCY AND CHILDHOOD.

Physiology, Hygiene, Pathology and
Therapeutics.

— BY —

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GEORGE S. DAVIS.
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Feeding on cow's milk, or cow's milk diluted with water, may appear to be harmless in many instances. Some children thrive on it. More, however, appear

*In his new "Lectures on Public and Private Hygiene, Erlangen, 1887," Prof. J. Rosenthal, says: "Cow's milk is richer in casein and fat than woman's milk." Still, the results of analysis differ to such an extent that, in a comparative list of milks, on the same page, 311, he publishes the following figures:

	SPECIFIC GRAVITY.	WATER.	CASEIN.	FAT.	SUGAR.	SALTS.
Woman..	1018-1045	87	2.5	3.9	6.0	0.5
Cow.....	1033-1045	87	3.3	3.7	5.0	0.7
Ass.. ...	1033-1040	90	2.2	1.4	6.2	0.3
Goat.....	1030-1035	87	3.7	4.1	4.5	0.9
Sheep....	1034-1041	82	7.9	5.8	4.9	0.7

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only to thrive on it. For increasing weight and obesity are not synonymous with increasing health and strength (p. 51).

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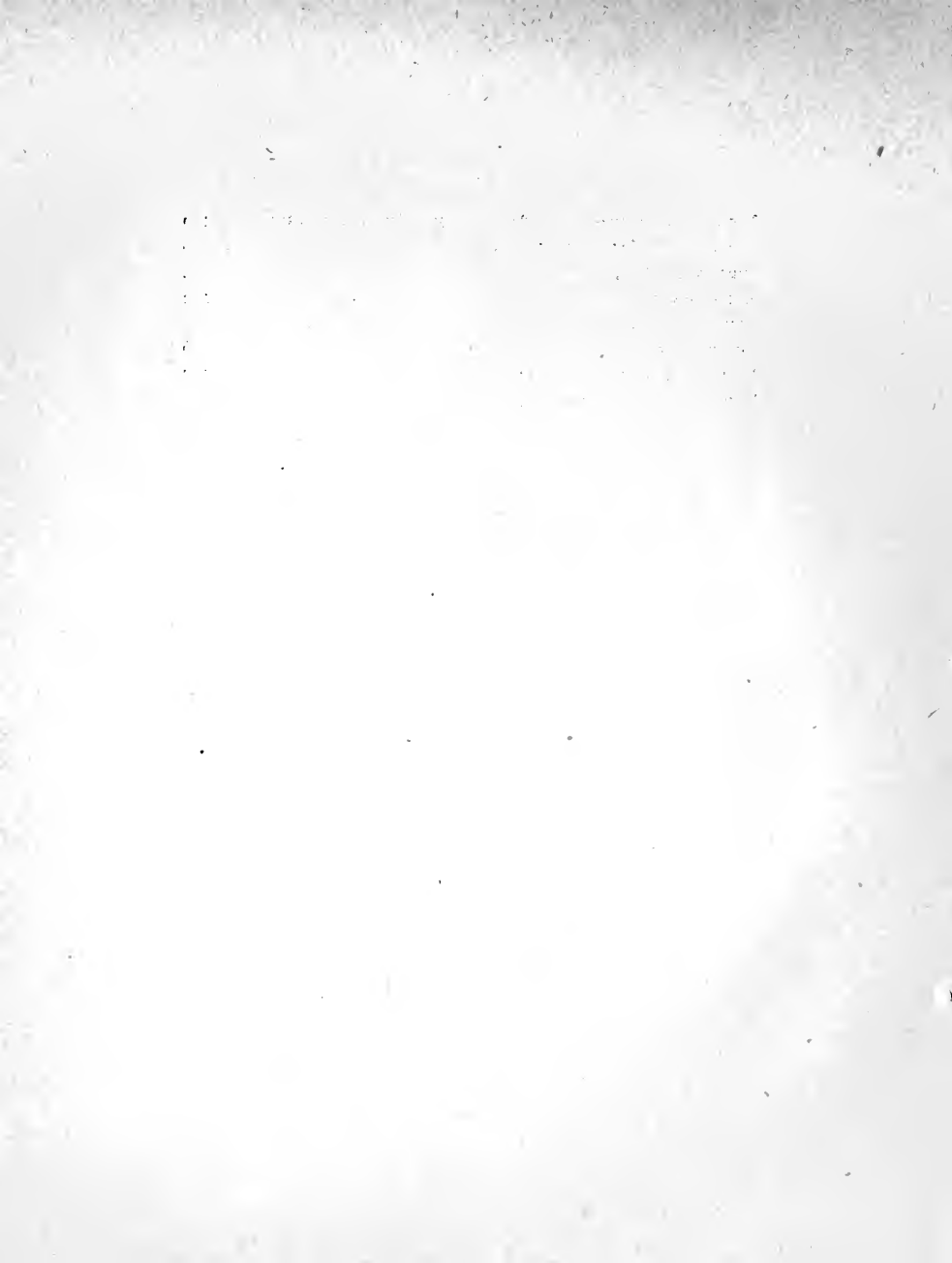
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INTRODUCTION.

Of all the fatal affections that occur in the first year of life, forty per cent. are diseases of the digestive, and twenty per cent. diseases of the respiratory organs.

In the second year the main cause of death changes entirely. For of forty-five deaths from the two causes in that year, but nine are due to diseases of the digestive, and thirty-six to affections of the respiratory organs.

Thus, in the first year the stomach and intestines, and in the second, the bronchi and the lungs, are the sources of the high death-rate. In New York city, however, we meet with a high rate of mortality from digestive disorders even in children of more than one year of age, and the second summer is therefore regarded with awe and fear amounting to superstition. In fact, public opinion looks for a higher rate of mortality in the second than in the first summer. The fallacy of this assumption can be easily corrected by statistical reports, and the high mortality itself should be easily reduced by such parents as can become convinced, that it is external causes which kill their children, and not the natural course of development. The second summer is a period of danger, in part only, because of the heat, but mostly because of errors in feeding. Conscientious and intelligent families, in good circumstances, are not liable to loose their infants in the second summer.

Mortality diminishes with every day of advancing life. Every additional hour improves the baby's chances for preservation. Almost one-half of the infants who die before the end of the first year, do so before they are one month old. The causes of the disease are the more active the earlier they are brought to bear upon the young with their defective vitality.

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Two grave conclusions are to be drawn from that fact. The first is, that diminution of early mortality depends upon avoiding diseases of the digestive organs by insisting on normal alimentionation. That is particularly important in the first few months. While it has been shown that breast milk lowers the rate of infant mortality through the entire first year, it does so much more in the first few months. Thus, although infants may not be fed on breast milk through the whole of the normal period for nursing, very great gain is accomplished by insisting that they shall be nursed for at least a limited time, if only a few months. There are but few mothers but are capable of nursing during that brief period, and none but contributes to the illness or death of her baby by refusing to nurse it, at least through the first dangerous weeks.

The second conclusion is the following: That the hygienic rules for infants concern the digestive organs mainly, so much so, that infant hygiene and the hygiene of the digestive organs in infants appear to be nearly identical.

These are the reasons which induced me to make the digestive organs of infants and children the subject of this brief manual. In so doing, I was aware of the frequent failures of the attempts at saving those who have fallen sick, and of the greater possibility to prevent disease than to cure it. Moreover, it appeared to me no thankless task to look upon the pathological changes, which become the subjects of our therapeutical endeavors, as the mere results of anomalies of the physiological functions. Thus I propose to treat first of the physiology of the digestion of childhood and the main points of its hygiene. Their lessons render the morbid changes more intelligible.

Some of my readers may know that I have written before on these and similar subjects. I refer only to my "Infant Diet," 2d edition, 1874; my contribution to A. Buck's "Treatise on Hygiene and Public Health," vol. i, New York, 1879,

and to C. Gerhardt's "Manual of the Diseases of Children," first volume, 2d edition, 1882, and occasional articles in medical journals. Besides, my practical experience, extending over more than a third of a century, may justify this attempt at appearing before the medical public with expositions, which cannot be considered trite and superfluous, as long as the mortality from digestive disorders amongst infants and children is as appalling as it is known to be.

A. JACOBI, M. D.

110 West 34th Street, New York, October, 1887.



CHANGES OF BREAST-MILK.

In many of the digestive disorders of the infant the best preventive, and often curative aid, is the breast-milk of mother or wet-nurse. That is an axiom, an indisputable law of nature, as long as the circumstances of the case are favorable. In view of the great mortality in the first few months, breast-milk is the one and indispensable food for those of that age. It is true that a baby may be taken sick with intestinal disease in spite of being nursed at the breast, for there are *many* causes of disease; it may, indeed, occur that babies are taken sick *because* of being at the breast. And it is those cases that both mothers and physicians ought to be well acquainted with. Sometimes it is not the breast-milk which is at fault, in the beginning, but the faulty use it is put to. Many babies suffer intensely because they are not limited to intervals of from 2 to 4 or 5 hours, as required by either age or constitution. In their cases, by too frequent feeding, both the milk of the mother and the digestion of the infant, are impaired. Here regularity is the sole indication. Sometimes, though fortunately in few cases only, there appears to exist an idiosyncrasy not explained, on the part of the baby who cannot thrive on the milk of the mother, but may do so after a change of food. In many cases, however, there are demonstrable dangers in the very breast-milk of either

mother or nurse; there may be an undue percentage of fat, or of cheese, or of salts, or of sugar, or even accidental admixtures. These may occur in the secreting organ (thus blood may be found in the milk) or be traceable to the circulating blood of the whole system; of the latter they may be the very constituents, or foreign bodies floating in it. They can be classed as either morbid dispositions or as actual admixtures. Women suffering from constitutional syphilis, chronic consumption, or anæmia, extensive rhachitis, severe nervous derangement, hysterical or other, those suffering from care and hard work, and those who are compelled to take a great deal of medicine, will serve their babies best by not nursing them at all.

In regard to the influence of medicines, the opinions have been divided. It was claimed that milk, being a secretion of the gland, and not a transudation from the blood, could not contain foreign material to any great extent. That is true as far as an absolutely healthy woman and normal milk are concerned. But the first period of lactation yields colostrum, not normal milk, and very often the latter is changed into a colostral condition, such as it was soon after birth, containing different-shaped fat globules, more sugar, soluble albumin; in fact, real blood serum. This may take place in every case of impaired health. And the more serum of blood is contained in any milk, the easier is the admixture of soluble substances circulating in the blood. As I formulated the

subject some years ago, milk secreted from an insufficient mamma, by a woman not in full health and vigor, by an old woman, by a very young woman, by an anæmic woman, by a convalescent woman, who has consumed a large portion of her albumin, be it circulating or tissue albumin, by a neurotic woman with frequent disturbances of the circulation — milk, in fact, which is not the normal transformation of the elements of the mammary glands, but consists of more or less transuded serum, is apt to be impregnated with elements circulating in the blood. The indications on the one hand, for the permission to nurse, on the other, for the administration of medicines to a nursing woman, require, therefore, a greater strictness than is usually conceded. At all events, the good results obtained in many cases of ailment on the part of infants, by artificial feeding, in preference to nursing, are often better than merely accidental. *

Changes in animal and woman's milk in consequence of nursing, diseases, organic and inorganic substances are very frequent, and their occurrence was considered to take place at a time when exact analyses were out of the question.

One of the many pretty stories of the younger Pliny (xxv. 47) is as follows: Lysippe, Iphinœ and Iphianassa were the three daughters of Proteus, King of Argos. They were poisoned by the milk of goats

* Inaugural address *Trans. Med. So.*, State of N. Y., 1882.

fed on hellebore. They became insane, roamed about the country, and seduced and abducted the other young girls of the community. The two surviving princesses were cured by Melampus and his brother Bias, who married them, and the rest by the most vigorous young men who hunted them up.

In Gerhardt's Handb. d. Kinderk. Vol. II, I have collected a large amount of material, partly from reliable veterinary literature, showing the influence of different kinds of food, sickness, and drugs upon the milk of animals. Here I shall refer only to a number of facts belonging to our own race.

Zukowski observed that tired and hungry wet-nurses gave milk that was not nourishing. Among the wet-nurses at the foundling-hospital in Moscow, the percentage of fat in the milk when they were first admitted was from 1.8 to 3.0 per cent.; among those who had been in the institution a short time, it was 3.2 to 4.0 per cent. Seasons of fasting exerted a great influence upon the milk, especially upon its fatty element, and many nursing children were wont to become sick at such times. Upon the first day of the fast, the fat usually decreased to 0.88 per cent., but rose again to 3.4 per cent. by gradual habituation to the retrenchment in diet, and probably by the appropriation of an extra quantity of albumin from the general system, which satisfied the demand of the milk glands. The instrumentalities most rapid in their action upon the milk, are those which take effect

through the nervous system, and their action is upon an organ in which, when functionally active, rapid changes occur.

Firmin (Bull. Thérap., 1886; Schmidt's Jahrbücher, 1875, No. 8) reports the case of a child six months of age, who was attacked with urticaria, fainting, vomiting, and offensive diarrhœa; all of these phenomena were produced by the mother's milk, after she had partaken of oysters, crabs, cod-fish, and shad. It may be proper to mention here an observation which was made by R. Monti (Schmidt's Jahrb. 173 p. 160). The right arm of a nursing woman, whose right breast was functionally incapacitated by mastitis, was treated locally with ammoniacum and camphor; the result was a marked decrease in the secretion of milk by the breast upon the healthy side. The passage of coloring matter into the tissues within a short space of time is a well-known possibility. According to Mosler, milk will become yellow through the influence of marsh turnips, *caltha palustris*, saffron, and rhubarb. According to Schauenstein and Späth, it becomes red after the ingestion of rhubarb, garlic, *opuntia*, *rubia tinctorum*; it becomes blue from the ingestion of *myosotis palustris*, *polygnum*, *mercurialis*, *anchusa*, and *equisetum*. This blue discoloration which pervades the entire volume of the milk so affected must not be confounded with the superficial blue layer which occasionally appears upon milk which has stood for some time. It gradually permeates the en-

tire volume when added to milk which is otherwise pure. The milk thus treated will not lose its color by triple filtration. This color is dependent upon the growth of a fungus, which must not be confounded with Hessling's sour-milk fungus, and is identical with penicillium glaucum, and aniline blue, giving rise to severe attacks of catarrh of the stomach and intestine, and severe prostration.

Next to the coloring matters, the ethereal oils combine most readily with milk before it leaves the gland. The ethereal oil from rape seed, impregnated with sulphur is quickly passed into the gland. In the same way we get the peculiar odor from thyme, wormwood and garlic, when these substances have formed a part of the diet. The foregoing facts being established, the important question, theoretically as well as practically, arises: How far can disease be propagated through the medium of milk? Not all the chemical and microscopical analyses which have been made for the purpose of solving this question, can lay claim to absolute reliability. Percy ("What effect has the meat or milk from diseased animals upon the public health."—*N. Y. Med. Jour.* VIII 1866), has contributed reports of forty analyses of milk, which go to show that there is a chemical difference between the milk of well and sick cows, and that important ingredients are entirely wanting in the latter. He admits, however, that he has not been able to detect the presence of an active poison in it. Dur-

ing the same decade were published Hexamer's over-drawn pictures in reference to the swill-milk scandal in New York, which created a great impression in Europe and quickly passed out of notice in New York. Dewees has observed yellow fever among nursing women and has been unable to see positive harm to their infants from the use of their milk. D'Outrepoint observed the same thing in patients with petechial typhus. In typhoid fever I have often made a similar observation. If the disease be diphtheria, I am chiefly concerned that the infants should not be exposed to direct contagion and that they should approach the mothers only for the purpose of nursing. On the other hand well-authenticated reports are published (Twelfth report of the medical officer of the privy council 1870 p. 294.—J. C. Gooding in *Med. Times and Gaz.* 1126, 1872) to the effect that unboiled cows' milk, from animals which were affected with mouth and hoof disease, produced derangements of digestion, fever, vesicles and swelling upon the lips and tongue, and marked weakness upon attempting to walk. There is likewise a published report of a case in which a number of officers and men belonging to an English ship, suffered severely after drinking some milk which had been obtained from goats which had fed upon euphorbiacæ. This occurred Nov. 27, 1861. In regard to the infectiousness of animal flesh when taken into the stomach, authentic reports abound. Gamgee and D. Livingstone report the flesh of animals which had

suffered from epidemic pleuro-pneumonia, to cause carbuncles and furuncles. D. Livingstone emphasizes the fact that boiling and roasting did not nullify this poisonous influence. From this it is sufficiently evident that goats, sheep, cattle, birds, and fishes may consume many poisonous substances which are harmless enough to them, but are dangerous to those who afterward eat their flesh. The milk of a syphilitic mother was seen to be directly injurious in a case reported by Cerasi (*Gaz. di Roma Jul.* 1878).

Gallois, Appay, de Amicis, were unwilling to believe that this last statement was founded upon fact. The same is true of Banzon, whose opinion is remarkable, for he is even willing that tuberculous mothers should suckle their young. Fr. Unterberger (*Rig. Zeitung*, 1877, No. 69; *Zeitsch f. Thiermed*, 1878, p. 466) gives no absolute opinion upon this subject. He thinks, however, that the milk from tuberculous cows should be boiled, under all circumstances. Bollinger (52nd Vers. d. Naturf. u. Aerzte) believes, like many others since, that the infection of human beings is possible by means of the milk of tuberculous cows. We should, therefore, avoid using the milk of old cows, which are frequently found to be tuberculous. In all cases the milk ought to undergo proper treatment before being used. Virchow (*Berl. Klin. Woch.* 1879, 17, 18) does not deny the possibility of infection through a tuberculous cow, and calls to mind the observations of Kolessnikow (*V. Arch.* X p. 531) in re-

gard to the pathological changes which take place upon the udder of tuberculous cows, and have a possible influence upon their milk. Uffelmann relates the case of a child who died from tuberculosis, where it was impossible to trace the origin of the disease to anything but the milk of a tuberculous cow. (Arch. f. Kinderh. II). Stang had a similar case in a child five years of age. It is difficult to point to positive proof in these cases. Many more histories must be collected before we can be justified in prohibiting the customary supply of milk in every case of constitutional or severe local disease. But the interdiction will be warrantable in individual cases, upon the ground of probability.

Of importance in connection with the foregoing is the question of transmission of inorganic materials into the milk. While organic chemistry has not yet made sufficient progress to give a decision as to whether the gramme of quinine which gives a bitter taste to the milk, exists in the milk as quinine or as something else (Chevallier and Henry), or whether alcohol, opium, or morphine are again recoverable from the milk, inorganic chemistry, on the other hand, is capable of better results, although here too, there are differences of opinion in abundance. The direct experiments which were made upon human beings were only of a clinical character. Experiments upon goats and cows in this direction have also been made. Harnier and Simon found no iron (yet the ash

residue of human milk always contains much phosphoric acid, 0.21 less than that of cow's or swine's milk, according to Wildenstein), they readily found salts, however, in loose combination, which quickly disappeared. According to Bistrow's observation anæmic children improved rapidly, when those who nursed them took iron. According to Wildenstein's experiments upon a goat, the quantity of milk, under the use of iron, was less, but its specific gravity was greater, and the quantity of iron in the ash increased two-fold, but not until the iron had been in use for twenty-four hours. A small quantity of bismuth was found by Lewald; a large quantity by Chevallier and Henry, and a trace by Marchand. Fifteen grammes of iodide of potassium were found by Lewald in the accumulations of four days. In the following three days twenty-one grammes more were recovered and then all traces disappeared. This was in accordance with a previous calculation. In a further use of iodide of potassium, the milk gave an iodine reaction at the end of four hours, and continued to do so for eleven days.

Lazanski made observations upon a syphilitic mother and her infant five months of age. The mother had been infected two years previously, had no indications of the disease upon the genital organs, but had syphilides in the groins, and swollen glands. The child was affected upon the skin and the mucous membranes. The mother received half a

gramme of iodide of potassium twice a day, the result being that the urine gave an iodine reaction upon the same day that the treatment was begun. In the child the iodine reaction appeared upon the following day. Gemmel also relates that a cow which received ten grammes of iodide of potassium daily, began to dispose of it through the milk glands, upon the tenth day. In a case where the nurse was treated with iodide of potassium, a desired effect was soon produced upon the child which she was suckling. Upon the basis of such facts, Levisseur recommends in the secondary syphilis of infants, the use of iodide of potassium through the medium of the breast-milk, likewise the sulphate of quinine in neuroses of an intermittent character, and arsenic for the moist eruptions upon the skin. Arsenic was found seventeen hours after it had been given, and it continued to be traceable for sixty hours thereafter. (Hertwig states that medicinal doses for a cow are sufficient to poison the meat). Lead may be separated from the milk, likewise oxide of zinc, and probably all other preparations of zinc. They were found in from four to eight hours after they had been given, and disappeared after fifty or sixty hours. Antimony passes into the milk, therefore special care should be exercised in prescribing it. Mercury has not been found by Peligot, Chevallier and Henry, and Harnier, but it has been found by Lewald and Personne.

O. Kahler has made the cases of three women

who were receiving mercury by inunction, the occasion of accurate investigations. The milk was examined for mercury by the chemico-electrolytic method of Schneider, but none was found. He considers the affirmations of Lewald and Personne, under this head, as questionable. In my personal experience, the results of mercurial treatment of the mothers and nurses of syphilitic infants, where the disease was hereditary, has not been satisfactory; but in cases where the symptoms of the disease first appeared after the child was some months old, the customary internal treatment has yielded very beautiful results. Tudakowski was able to detect traces of mercury in three hundred and sixty six grammes of milk tested according to Schneider's method. Likewise, Klink treated a syphilitic mother with twenty-five inunctions of ung. hydrarg., giving twenty grammes at each treatment. The infant had large condylomata and adenitis, and quickly improved under the treatment (during the same period the infant had three baths, each containing 0.3 gramme of corrosive sublimate). Carbolic acid, bicarbonate of potassium, chloride of sodium, Glauber's salts and sulphate of magnesium are all transmitted to the milk. The vegetable acid salts loose carbonic acid to the milk, but the alkaline compounds of sulphur, according to Marchand, do not. Stumpf found iodine speedily in the milk of woman, but slowly in herbivorous animals. It is found in combination with casein, but in uncertain quantities. Alcohol he did

not find in the milk of herbivores, lead in traces, and salicylic acid in small quantities. A large number of similar observations and experiments have since been made, too many to be here recorded. One of the most interesting is that of Dr. Koplik, who observed iodine eruptions in a baby, whose mother took iodide of potassium in but small doses. (*Med. Record*, Sept. 24th 1887.)

DIET OF WET-NURSES.

If after all that has been said we have succeeded in fairly bringing forward the question as to how the nourishment of a nursing woman should be directed, in order to obtain the most desirable ends, the answer can only be sketched, it cannot be given in all its details. Powerful salts are to be avoided, under all circumstances, as well the salines as the more powerful drastics, likewise an injudicious use of table salt, ethereal oils and strong condiments. Furthermore everything is to be avoided, whether of substances taken into the stomach, or improper habits, which have a tendency to derange or to weaken digestion and assimilation. Generally the wet-nurse looks upon her position as one would regard "a land which flows with milk and honey" and where "roasted pigeons fly into the mouth"—Canaan and America at once,—and where there is no end of things to eat until the appetite is satisfied, or spoiled. Somewhat more of albuminous food is indicated, than under ordinary circumstances. Too much of this, or a diet composed exclusively of it, would destroy health, and the milk secreting power as well. Much fluid food and an abundance of water will increase the volume of the milk. A moderate use of beer may act as a stomachic. Water and barley-gruel act upon the milk as well by virtue of the water which they contain as by their nutritious qualities, and the same is true

of tea in moderate quantities. Potatoes, in large quantity, and other carbo-hydrates are to be avoided as a principal means of nourishment. Fat in moderate amount is desirable. In general it may be laid down as a fundamental principle, that a wet-nurse will have the largest quantity, and the best kind of milk, when using the same nutriment to which she was accustomed before pregnancy, provided it kept her in good physical condition, with the addition of a certain quantity of albuminoids, and plenty of fluid food. What the nursing woman spends in the shape of milk, must be returned to her. The daily requirements of a woman who is not doing hard work, nor suckling a child are

Albumin gm. 85.0

Fat, 30.0

Carbo-hydrates 300.0

The requirements of a nursing child of five months who receives a daily allowance of 800 grammes of breast milk are

Albumin gm. 20.0

Fat, 31.0

Sugar, 48.0

This quantity must be obtained from the reservoir of the mother, and according to most experience it is best obtained from a richly albuminous diet. Where we are dealing with small atrophied breasts, and it is necessary to stimulate the secreting function, considerable time is required before a free and satis-

factory flow of milk can be obtained. If we are looking simply to keeping up an abundant supply, carbo-hydrates may prove satisfactory. The most common question, however, is in regard to the improvement of the substance of the mammary glands themselves. It must not be forgotten that tissue changes and good health do not depend alone upon what is eaten. A wet-nurse must not be thrown too suddenly upon conditions which are quite strange to her. She must live, as nearly as possible, in the manner to which she has been accustomed. A nurse who is removed from the hay-field or the kitchen table to the boudoir of a lady, and who is held in restraint from fear lest she might eat a raw apple, or drink a glass of beer, or meet her lover, or who is deprived of her customary physical exercise, will not remain healthy nor give a proper quality of milk. In accordance with these fundamental directions, the various articles must be criticised which have been recommended as proper means of nourishment and diet during the period of lactation. The list of such articles contain beer, buttermilk, milk, chocolate, thick soups, husked grains, oysters, crabs, sea-eel soup, etc. If all these dietetic means do not accomplish their end, one has to look around for therapeutic measures for the stimulation of the milk-secreting function, with more or less of reason, and more or less of confidence. C. Gesner, in his heading (p. 45), "Concerning those

things which make the milk plentiful,"* has referred to all the materials used, from Galen's time down to his own. Rosenstein recommended a remedy, Hufeland a milk-making powder, Moleschott the edible chestnut, Routh the leaves and stems of *ricinus communis*, Gillian the extract of the leaves of *ricinus communis*, and in England and America the *ricinus* leaves applied upon the breasts won for themselves a popularity far exceeding their value. The list of galactagogues which Routh published (p. 281) makes a very respectable appearance, but from my own experience, and from that of others, I cannot say that I can boast of great success. I have used the electric current many times to stimulate the flow of milk, and with good results. The galvanic current, with its influence on circulation, has, however, a better effect.

* "De his quæ lactis ubertatem faciunt."

SUBSTITUTES FOR BREAST-MILK.

Those infants who are deprived of breast milk, or never had it, or have an insufficient supply of it, require artificial feeding. The material resorted to ought to be as much like woman's milk as possible; and naturally, when human milk cannot be had, animal milks are selected. Amongst them only two are available to any great extent, that of the cow and the goat. If there be any objection to either, it is principally valid in regard to the latter. For the chemical incongruities and other difficulties, to which I shall have to allude in regard to cow's milk, are even more pronounced in that of the goat.*

* A. Jacobi, Inaugural Address, Trans. Med. Society of the State of New York, 1882.

MILK OF ONE COW.

Is it desirable that a baby should be fed on the milk of one cow exclusively?

The milk of a cow is not necessarily uniform and unchangeable. Its nitrogenous constituents vary. Its composition, and at all events its taste, are frequently altered by changes in feeding, or by the accidental admixture of an odoriferous or purgative herb. The nursling takes the whole contents of the mother's breast; from the udder of the cow he gets but a small portion of the milk. This varies for different reasons. The first period of milking yields milk containing less fat than that which is obtained towards the end of the milking. Boussaingault divided the time of milking into six periods; in the first he found 1.7 per cent. of fat, in the last 4.08. Hofmann's figures vary still more; they range between 1.63 and 10.0. Besides, milk taken from a pail contains more fat in its upper part than in the lower. Pasture, or dry feeding of the very same cow work a great difference in the milk. Thus the most careful dairies established for the purpose of supplying infants and children with cow's milk, in Frankfort and other places, insist upon uniform stable feeding through the whole year. Diseases of the cow influence the milk considerably. Tuberculosis is frequent. Thus the baby fed on the milk of one cow is, as it were, an appendage of that cow, and dependent upon the animal, and the practice of

relying on the milk of one cow, is inferior to making use of the mixed milk of a whole dairy. By so doing we dilute, and diminish, dangers which will attend changes effected by feeding and sickness.

RAW OR BOILED MILK.

Boiling removes a small portion of fat and casein which is collected on the surface. This loss is desirable, though the quantity thus withdrawn is too small. Still the removal of fat by allowing milk to stand is improper, inasmuch as during the time necessary for that purpose the milk will acidulate. Boiling retards acidulation. Amphoteric (neutral) milk becomes alkaline through boiling. The formation of lactic acid is delayed by boiling, through the expulsion of a large quantity of gases contained in the milk when it leaves the udder.* It is true the taste of boiled milk is less pleasant to most people, but its possible dangers are less to all. Still, with the "volatile principle which is destroyed by boiling, of unknown nature, but presumably beneficent effect," which is good-naturedly talked about by some authors, I have but little sympathy. Milk changes very readily. It takes the odor of smelling substances near by, it is more than merely suspected of communicating contagious diseases by carrying bacteric poisons (or poisonous bacteria?), it acidulates very rapidly. Bechamp has observed the formation of alcohol and acetic acid within the udder.

*Three per cent., according to Hoppe (carb. acid 55, 15, Nitrogen 40, 56, oxygen 4, 29). According to Pflueger's arch. II, p. 166, oxygen 0.1-0.09 per cent., nitrogen 0.7-0.8 per cent., carbonic acid 7.6-7.4 per cent.).

Hessling reports milk which was so thoroughly filled with fungi that coffee drank with such milk became poisonous. Most of these changes are retarded, or interrupted, or annihilated by boiling. Any apparatus is good enough for that purpose. After having been boiled, the milk destined for the use of a baby during the day ought to be kept in clean bottles containing from three to six ounces, up to the cork, and the bottles turned upside down and preserved in a cold place. Such a bottle will keep longer than milk preserved in the usual way. Before being used, it ought to be heated in a waterbath. By repeating this heating of the whole amount of the day's milk, several times during the twenty-four hours, fermentation will be retarded, and digestibility improved.

CONDENSED MILK.

There are a few varieties of condensed milk in the market which claim to contain no sugar; others which are manufactured for the purpose of keeping an indefinite time, have a percentage of nearly fifty per cent. The milk distributed in New York for immediate use contains from eleven to thirteen per cent. Some manufacturers condense pure milk, others find it more in accordance with the health of their bank accounts to use skimmed milk. Thus, Soxhlet found but 60-80 parts of fat (instead of 100-110) for every 100 parts of nitrogenous substance. Now, what is "condensed milk"? Can it be expected that the great mass of the public will always be careful in selecting the same brand, though it be possible that the product be always uniformly prepared?

The sugar contained in the condensed milks is mostly cane sugar, in some condensed "Swiss" milks 14-18 per cent. of milk sugar and 24-30 per cent. of cane sugar (Werner and Kofler). Thus we cannot always be sure of the nature of the sugar in the article, much less of its quantity, Though nature allows of latitude, that required by the several manufacturers is perhaps greater than is convenient or admissible.

At all events, the different composition of con-

condensed milks explains the variety of opinions expressed on their effects. It has been stated that the formation of lactic acid is increased by it (Kehrer); that it gives rise to thrush and diarrhoea (Fleischmann); that it fattens children but predisposes them to rachitis (Daly). I fully agree with the authors who discard the use of condensed milk, in all cases where cow's milk is to be had. Frequently the choice is, in large cities, between two evils, that is, bad milk and condensed milk. In that case I permit condensed milk. But it ought not be used in the diet of babies when fair and unadulterated cow's milk can be had. This ought to be possible, if the same pains and some little of the money which is now used for condensing, were spent on supplying the children of the poor, by rich philanthropists.

OTHER MILKS.

The frequency of ill success when cow's milk was fed has given rise to many experiments with the milks of other animals. Koenig has the following analyses:

	Water.	Casein.	Albumin.	Total nitro- genous sub- stances.	Fat.	Milk-sugar.	Salts.	No. of An- alyses.	Reaction
<i>woman.</i>		<i>39.24</i>			<i>26.66</i>		<i>1.38</i>		<i>Neutral</i>
Sheep	81.63	4.09	1.42	6.95	5.83	4.86	0.71	16	
Lama	86.55	3.	0.9	3.99	3.15	5.6	0.8	3	
Camel	86.94	..	..	3.84	2.9	5.66	0.66	2	
Mare	90.71	1.24	0.75	2.05	1.17	5.7	0.37	27	
Ass	90.04	0.60	1.55	2.01	1.39	6.25	0.31	17	<i>Alkaline</i>
Sow	84.04	...	...	7.23	4.55	3.13	1.05	9	
Bitch	75.44	5.53	4.38	11.07	9.57	3.19	0.73	16	<i>alkaline</i>
Cat	81.63	3.12	5.96	9.08	3.33	4.91	0.58	1	
<i>Goat</i>	<i>90.62</i>			<i>8.78</i>	<i>12.0</i>	<i>3.38</i>	<i>1.04</i>		

According to Jacquemier, there are in one thousand parts of woman's milk 26.66 fat, 39.24 casein, etc., and 1.38 salts; in bitch's milk 97.20 fat, 117 casein, etc., and 13.50 salts. The observations on the effect of the latter are but few in number, and appear to have been recorded with a certain degree of preoccupation. Young dogs fed on woman's milk are said to have died of diarrhoea. Rachitical children fed on bitch's milk are reported to have recovered in an incredible time, even to the straightening of the curved limbs.

Mare's milk is very much like asses' milk. Its reaction is alkaline and remains so for days. When it acidulates, the casein is thrown out in small delicate

flakes, which are soluble in acids. The casein thrown out by alcohol is finely flocculent, like woman's casein. Even when dried and deprived of their fat, the flakes remain yellowish and loose; cow's casein becomes hard. Mare's casein is less soluble in water than woman's, but more so than that of the cow. In artificial gastric juice mare's and woman's casein behave equally. Thus in cases of necessity, or opportunity, mare's and asses' milk would be proper substitutes for that of woman.

GOAT'S MILK.

It contains more fat, more casein and albumin, more salts and less sugar than cow's milk. It contains very much more fat, casein, albumin, and salts, and less sugar than woman's milk. Its drawbacks as an exclusive nutriment for the infant are therefore still more serious than those of cow's milk. Besides, it has an unpleasant odor. I never saw infants taking it for any length of time, and seldom saw it agreeing with them nearly so well as cow's milk, given exclusively, may do in some cases. Its physiological effects have been studied, but the reports vary. Kehrler saw it behaving in artificial gastric juice like cow's; Kraus like woman's milk; Hauner's experience, like mine, is unfavorable to it; Stoessl fed eighty-seven infants—at least he says he did—on cow's milk or goat's milk, to the exclusion of anything else, up to the appearance of the teeth. The result was such bomb-proof health and vitality, that these eighty-seven children were *all* alive and well at the end of the fourth year. Who laughs?

The goat has been enthusiastically eulogized by Boudard; he is particularly stricken with the white, hornless goat for "its odorless milk, sweetness of temper (*douceur de ses moeurs*), love of the protecting stable life, aversion to freedom which might expose her to her enemies, large round eyes, sentimental mien, and classically formed nipples." It permits the

babies to be put to the nipple, it has been recommended as a nurse by Buffon and Saint Vincent de Paul, and its “heraldic emblems have been immortalized by heaven, air, earth and oceans.” Poor babies, to be fed on rhapsodies !

The main objection to goat's (and cow's) milk is to be found in their *large percentages of casein and fat*. Of casein, according to Biedert, and general experience, an average of *one per cent.* is all that can be digested. Of fat, every milk—even woman's—contains more than appears to be required for physiological purposes. This is the reason why Ballot recommended buttermilk as infant food. It is composed of water 90.62, nitrogenous substance 3.78, fat 1.25, milk-sugar 3.38, lactic acid 0.32, and salts 0.5. In it, evidently, fat is reduced in quantity, but casein, unfortunately, is not, and the additional lactic acid is a detrimental feature. Of buttermilk, Ballot cooks a quart with a tablespoonful of wheat flour (rice flour in cases of diarrhœa) for some minutes, and adds a gramme (grs. xv) of sugar. With this food he begins in the third week after birth, and succeeds in proving that many liberties may be taken sometimes with human digestion, without much apparent immediate injury.

FAT.

Fat, as contained in milk, is by no means a simple substance. It consists of at least nine compounds; it is probably identical in the different varieties of milk. It has been studied most extensively in cow's milk, in which it is found in different percentages. There is more of it in colostrum, in the upper layers of the milk contained in a pail or bowl, in the evening. Its average percentage is 4.3; that is a great deal more than is contained in woman's milk. Thus I have always taught that it is better to reduce the fat of the milk which is to be given to infants than to add to it.

The ways to reduce the amount of fat in cow's milk may differ. Buttermilk contains lactic acid, as stated above. To allow it to rise spontaneously, so that it can be *skimmed* off, allows lactic acid and fat acids to form, even in low temperature. The milk, after having thus been skimmed, has a specific gravity of 1035-1037, and contains water 90.63, nitrogenous substances 3.06, fat 0.97, milk-sugar 4.77, and salts 0.75. Thus *skimmed milk prepared, or obtained, in the usual way is objectionable* as a food for the young. But such milk as is deprived of part of its fat by the centrifugal machines of Lefeldt, Delaval, and others, which terminate their work within half an hour, may be used to advantage. Normal milk, such as Lefeldt operated upon, contained water 87.79, casein 2.73, albumin

0.68, fat 3.64, sugar 4.69; after the process of centrifugal separation had been finished, its percentages were as follows: Water 90.73, casein 2.88, albumin 0.49, fat 0.46, sugar 5.34, and salts 0.72.

CASEIN.

The high percentage of casein in cow's milk is not the only objection to the substitution of diluted cow's, for woman's milk. There are important differences in the chemical and physiological differences of the two caseins.* From the physician's point of view it is important to notice that solutions of mineral acids, lactic, acetic and tartaric acids, sulphate of magnesia, and phosphate of calcium do not coagulate woman's milk, as they do cow's milk. Coagula of woman's milk in the stomach will dissolve in a surplus of gastric juice; cow's milk will not behave so, according to Biedert (contrary to Putnam's observations, who denies the existence of this difference). Thus cow's casein is by far not so digestible as woman's milk, and, as stated above, there ought to be but one per cent. of such casein in an infant's food. To thus reduce the quantity of casein, and restore the equilibrium between casein and fat, Biedert has prepared a cream mixture, which, in a condensed form, has found its way into the market. His schedule for its preparation is changeable for every month of the infant's life, and reads as follows:

	CREAM.	MILK.	WATER.	MILK-SUGAR.	CASEIN.	FAT.	SUGAR.
1st month....	3 iv	.....	3 xii.	3 ss.	1 p.c.	2.4 p.c.	3.8 p.c.
2d month....	..	3 ij.	.....	.....	1.4 p.c.	2.6 p.c.	3.8 p.c.
3d month ..	... ..	3 iv.	.....	.....	1.8 p.c.	2.7 p.c.	3.8 p.c.

*A Jacobi, in Gerhardt's Handb. d. Kinderk., 2, Ed. I, 2, p. 91. Bunge in Jahrb. f. Kinderh. 1875, IX 1.

	CREAM.	MILK.	WATER.	MILK- SUGAR.	CASEIN.	FAT.	SUGAR.
4th month....	..	§ viii.	.....	.....	2.3 p.c.	2.9 p.c.	3.8 p.c.
5th month....	§ xii.	.....	.....	2.6 p.c.	3.0 p.c.	3.7 p.c.
6th month....	§ xvi.	§ viii.	§ liiss.	3.2 p.c.	3.0 p.c.	4 p.c.

These mixtures are ingenious modifications of Ritter's formula first proposed in 1863, which adds two or more parts of water to one of sweet cream, or Kehrér's, who uses one part of cream with two of whey.

A. V. Meig's cream food is prepared in the manner described in his book on "Milk Analysis and Infant Feeding," 1885, p. 74-76. I copy literally, because the deserving author ought to be heard in his own words. Still I take the liberty of marking such words or sentences which I want my readers to consider in regard to the difficulties of preparing the food, the time it takes, the intelligent management it requires, the expense it occasions, compared with what I claim are the absolute requirements for every infant food, viz., *accessibility to the poorest in pocket and brains in the land, simplicity, cheapness, and digestibility.*

"There must be *obtained from a reliable druggist* packages of pure *milk-sugar* containing seventeen and three-quarter ($17\frac{3}{4}$) drachms each. The contents of one package is to be dissolved in a pint of water, and it is best to have a bottle which will contain just one pint, as there is then no need for further measuring. The contents of one of the sugar packages is put into the bottle, and when filled with water soon dissolves,

and it is ready for use. The dry sugar keeps indefinitely, but after it is once dissolved *it sours if kept more than a day or two in warm weather*; it is understood, therefore that the sugar-water must be *kept in a cool place*, and if it should at any time become sour, which is *easily discovered if it is smelled and tasted, it should be thrown out*, and after the bottle has been carefully washed with boiling water, the contents of a fresh package dissolved. A milkman *must be found who will serve good milk and cream, fresh every day*. By good milk is meant ordinary milk, such as is *easily procured in most cities*, and not rich Jersey milk; and in the same way the cream should be such as is *ordinarily used* in tea and coffee, and *not the very rich cream* of fancy cattle. The reason that ordinary milk and cream are recommended is *because they are within the reach of almost every one*, and not because they are any better than the rich milk of high-priced stock. If Jersey milk was to be used, it would be *necessary to analyze specimens, and then make the necessary calculation*, as to how to dilute it to obtain the desired relative proportions of the proximate principles. When the child is to be fed, the nurse should mix together two (2) tablespoonfuls of cream, one (1) of milk, two (2) of lime water, and three (3) of the sugar-water, and then, as soon as the mixture has been warmed, it may be poured into the bottle, and the food is ready for use. If the infant is healthy, this quantity will not satisfy it after the first few weeks, and then double the

quantity must be prepared for each feeding. Twice as many tablespoonfuls of each of the ingredients must be mixed together, making sixteen tablespoonfuls (about half a pint) in all."

Biedert himself does not claim that his cream mixture is indispensable. On the contrary, he says in the very circular which accompanies his cream preparation. "The first requirement of an infant food is, to prove digestible for all infants including the feeble and sick. Such a food must not contain more than one per-cent. of casein. Therefore milk must be mixed, for the very young, with three or four parts of an indifferent food. This latter quantity must be gradually diminished. That mixture is far superior to any mixtures and artificial preparations thus far prepared, particularly those which contain large amounts of flour or sugar."

As the percentage of fat changes with that of casein in this mixture, Biedert concluded that it was necessary to add fat in those cases, in which the other was not well tolerated either by the well or the sick. Particularly for the latter he recommends it, until recovery renders the return to the original mode of feeding advisable. This temporary administration cannot prove very expensive. As for the fact that the cream mixture is more expensive than the simple food recommended as the rule, he further alludes to the expensiveness of a wet-nurse for which the cream mixture might be substituted from birth.

My readers will notice the modesty and unobtrusiveness in Biedert's expressions upon, and recommendations of, his preparations, particularly of the condensed mixture which is offered for sale. In this lies the difference between a manufacturer who, in laboring for his pecuniary gain by working on the credulity of the easily deceived public, announces his wares as panaceas for every ill and cannot see how the world went on before a benign fate sent him to redeem it, and the man of scientific instincts and humane physician who recommends his gifts for what he believes or knows them to be worth. It is self-understood that the author himself has no monetary interest in the sale of his "Cream preserve" (Rahm Conserve). The cream mixture of Biedert, indeed every cream mixture, requires that its emulsion should be complete. In one case in which it was not so, the fæces exhibited fat to the amount of forty per cent. Such occurrences must prevent the introduction into common use of such fat emulsions, for the women of the people at large, the house-maid, the nurse, will not spend the required time and pains in their preparation. Besides, cream is not the same thing always, and if accuracy in measuring percentages while nursing be really as indispensable as it is claimed, the irregularity in its composition is a serious obstacle to its use. On account of these very variations Biedert, indeed, compounded his "Cream preserve," which keeps for some time. When to be used after three or

four weeks, some milk has to be added. *Milk again!* of inequal quantity, and with all its actual or alleged dangers, and its variability according to whether it is country, city, morning, evening, dry feed, or pasture milk. And finally, what about the “cream preserve” itself? It comes from a factory through the walls of which you cannot look, is sent out from the office of the capitalist who wants to add profit to interest, and passes through the hands of tradesmen and advertisers. Safety is not accomplished in that roundabout way.

An excess of casein in milk is justly feared for its irritating influence. An excess of fat works in the same way. Even normal mother's milk leaves a high percentage of fat in the infant's fæces as normal movements contain twelve per cent. of fat. This percentage, when Biedert's mixture was administered, varied from 20.3 to 3.8. There is no report that this low percentage was complicated with anything like bad symptoms. The higher percentage, however, is uncomfortable, and dangerous. Arthur Meigs (*Milk analysis and Infant feeding*, Philad. 1885, p. 63) quotes a similar remark of mine contained in my article on *Infant Diet* published in *A. H. Buck's Hygiene and Public Health*, vol. 1, p. 112, and adds: “It seems scarcely wise, upon such theoretical grounds, to condemn the use of cream, particularly when the experience of many physicians has been that they were able to feed successfully upon cream, or

cream mixtures, children they were unable to manage any other way. Surely, Dr. Jacobi would not condemn the use of human milk, because fat may be found in the stools!"

Certainly not. It is not that it *may* be found, but it *is found*. That is no theoretical reason, but a universal fact. It is a better established fact than the experience of *many* physicians who were able to feed upon cream. What I do say is that as the infant intestine does not digest by far the quantity of fat contained in the normal infant food, we ought not to increase the amount of the indigestible (and in their high percentage useless) ingesta by deliberately adding to them. Biedert himself, a careful experimenter and the persistent advocate of his cream mixture, points out the danger of giving too much fat. It is he, who added the chapter of "fat diarrhoea" to our pathology, and he again, who advises the diminution of the percentage of fat in the food for the purpose of relieving that morbid condition.

ADDITION OF WATER TO COW'S MILK.

The dilution of cow's milk, boiled or unboiled, with water, with or without the addition of sugar, was naturally the first attempt to make cow's milk similar to that of the human female. The thousands of recommendations as to definite proportions and percentages, distributed as they are through books and journals, are only a repetition of that which the mothers of all climates are accustomed to do. In many large lying-in institutions nothing is furnished for the nutrition of the infants but milk and water. This is the way in which they were fed, according to Parrot, at the Hospices des enfants assistés. The nursing child ought to have milk, and milk alone, says Pfeiffer.

After Natalis Guillot (who was the first to introduce a method of systematic weighing, for the purpose of ascertaining the influence of nourishment), had placed his figures entirely too high, in demanding 20-25 daily nursings of 25 grammes each time, Bouchaud came to the more correct estimate of 8-10 nursings, of three grammes each, of mother's milk upon the first day of life, of 15 grammes each upon the second, of 40 upon the third, and of 55 upon the fourth. From the fourth day the quantity is to be increased slowly.

According to the same author, the quantities may be tabulated as follows:

1st day.....	30 grammes (1 ounce).
2d day.....	180 grammes (6 ounces).
3d day.....	450 grammes (15 ounces).
4th day.....	550 grammes (18 ounces).

After the first month 650 grammes daily, after *20 ounces* the fourth 850, between the sixth and the ninth *24 ounces* 950. These figures Jacquemier has taken as the foundation of his directions for the dilution of cow's milk. He mixes two parts of cow's milk with one of water, this being the same mixture as that used by Parrot in the Hospice des enfants assistés. In this way the child gets upon the first day 20 grammes of milk, upon the second 100, upon the third 300, upon the fourth 366. After the first month the quantity is 434 grammes daily, after the third 460, after the fourth 566, between the sixth and the ninth 634; in all of which cases half as much water is added. This dilution has been approved of by many authors and practitioners, with the limitation that in the case of very small children the quantity of water is increased; for those who are larger it is diminished.

We now come to the question as to the influence which an excess of water has in the dilutions. Is it harmful, unimportant, or useful? Is the water like useless ballast, annoying the skin and kidneys, and increasing the number of soiled diapers only? Or has the addition of water another significance?

The influence of the absorption and elimination of water has been carefully studied. Water and

urea stand in fixed relations to each other. Bischoff (*Der Harnstoff als Maasstab des Stoffwechsels*, 1853) found an increase in the quantity of urea as there was a greater quantity of water passed through the kidneys, in man and in dogs. Genth arrived at similar results in experiments which he made upon himself, when he used a quantity of nourishment similar to that used by Bischoff (*Unters. üb d. Einfluss d. Wassertrinkens auf d. Stoffwechsel*, 1856). Voit reached the same conclusions (*Unters. üb d. Einfluss d. Kochsalzes, u. s. w.*, 1860), but also ascertained that the quantity of urea is increased only when the quantity of water passed through the kidneys is increased (*Zeitsch. f. Biol.*, 1866, p. 338). Argueing in the same vein, E. Wolff says "we must strenuously avoid in practice all causes which can promote a greatly increased consumption of water, such as watery food, too much salt, high temperature of the stable, as in this way many of the means of fattening are lost" (*Fütterung der Haustiere*, 1876, p. 310). But neither child nor man is fed simply for the purpose of being fattened like animals. Fattening takes place in animals by means of an obstruction to a regular and satisfactory tissue change, and is morbid. Where an active tissue change is desired, a watery diet is not at all contra-indicated; on the contrary, only in pathological conditions, where material for the body must be obtained at almost any cost, where the digestive and lymph organs are in bad condition,

would it be prudent to retard tissue changes. In all other cases which are in any way normal, health and strength progress in parallel lines with tissue changes. Water stimulates physiological changes. The excretion of sulphate of potassium, or of sulphates in general, of phosphate of sodium, and phosphatic earths, of chlorides and of urea is increased, likewise the discharge of excrementitious matters from the intestines, and of carbonic acid. In proportion as this takes place, the volume of the solid substance of the blood increases. The serum loses water and chloride of sodium, and tissue changes become less rapid. With a fluid diet the temperature is lowered, and the heart pulsations and the action of the lungs are retarded. When no water is taken, oxalic acid accumulates in the blood. Of the water which is introduced into the blood, a portion enters the blood globules. The greater the percentage of solid constituents the greater is the proportion of water which is given off to these solids, and the more chloride of sodium and other salts will be released by the blood-cells. Of course these products will bear no absolute relation to the quantity of water taken up. The addition of fifty times its volume of water produces a variation in the quantity of water absorbed by the solid constituents of from 12.2 to 19.8 per cent. But these changes are great enough to influence favorably the tissue changes (H. Nasse, Arch. f. d. ges. Phys. xvi., 1878, s. 613).

The free dilution of children's nourishment with water is demanded upon the following additional facts. Only to a certain limit will pepsin be furnished for digestive purposes. Probably a portion of this is not entirely utilized. A great quantity of water is necessary to assist in pepsin digestion. In artificial digestion albumin often remains unchanged until large quantities of acidulated water are supplied. Without doubt many disturbances of digestion are to be explained by a deficiency of water, certainly many more than are due to an excess of it, as it is so quickly absorbed.

For the reasons given, I advocate under all conditions a plentiful addition of water to children's food. In this connection I would lay stress upon the fact that, as a rule, small children receive water only as they get it in their milk. Alike in summer and in winter, it is probable that the fact seldom occurs to a mother or a nurse that a child can be thirsty without being hungry at the same time. Certainly many a discomfort and even sickness in a child is conditioned upon the fact that it has been compelled to eat in order to get its thirst satisfied, and often has to suffer thirst because the over-stimulated and injured stomach will take no more nourishment at irregular and too short intervals. There are also normal products of digestion capable of producing disturbances in the digestive process, chief among which is peptone itself. I have, therefore, considered it necessary in prepar-

ing rules for the feeding of children, which the New York Board of Health has annually published and distributed, since 1872, to insist upon giving infants who cannot ask in so many words for it, an occasional drink of water, at least during the hot weather. When there is the least ground for the supposition that the drinking water is contaminated with germs of disease, or where it is unusually hard, it should be boiled before its admixture with children's food, whether the diet be of milk or a mixed one. In general it will give greater satisfaction to use the boiled water systematically even where there is no apparent urgency for it, for very young infants.

ADMIXTURE OF SALT.

The rôle of salt in the matter of nourishment is an exceedingly important one. It is generally known that animals are made greedier for a proper quantity of food by the addition of a moderate quantity of salt, (say 30—50 grammes 1—1½ ounces) daily for each thousand pounds of live weight) and that the food thereby gains not only in palatableness, but also apparently in nutritiousness. “On the other hand, we know with little definiteness whether salt increases the digestibility of the food as a whole, or whether it has no such effect.” (E. Wolff.)

It is quite certain that by the active tissue change which is accomplished by the salt, the desire for food is stimulated, that which is already in the intestines is better retained and absorbed, and the residue is discharged more thoroughly altered than without the use of this substance. Carnivora do not need salt, herbivora do need it because, although the other mineral elements necessary for the animal organism are provided in their food in sufficient quantity, and in a more or less proper condition of preparation, the required amount of salt is wanting. Particularly is the relation of the sodium to the potassium disturbed. In the food of carnivora and of herbivora, the *absolute* quantity of sodium and of chlorine is very nearly the same, but in the food of the herbivora there is two to four times as much potassium relatively as in that of

the carnivora. Therefore, there is found in the blood of herbivores an abundance of potassium salts (phosphates, etc.), which needs antagonizing by sodium for the purpose of elimination.

When Bunge took large quantities (18—24 grammes) of the phosphate and citrate of potassium for four successive days, he lost half of all the sodium in his circulation. On the following day very little was discharged, because he had but little left. (*Zeitsch. f. Biol.* IX., 104, 1873; X., 127, 295, 1874).

In the body of the child the physiological effect of salt is all important, no matter whether it is directly introduced through the mother's milk, or added as a condiment to the cows' milk, and vegetable diet. A portion of that which is introduced may be absorbed in solution, another portion, however, will certainly be broken up into another sodium salt, and into hydrochloric acid. (Beneke). This normal ingredient of the liquid contents of the stomach, serves without anything further as an excitant to the secretions of the glands, facilitates digestion, and stimulates the appetite. The excess of acid which may get into the intestinal canal unites with the sodium of the bile in the duodenum, assisting in producing a second combination of chloride of sodium, and this is again dissolved in the intestines. From this point another active usefulness begins; it consists of osmosis from the surface of the intestine to the intestinal villi and blood-vessels, from the villi it passes into the sub-

stance of the blood, from the serum into the corpuscles, from the blood it goes into the tissues, and out of them, until final elimination. It is chiefly chloride of sodium, other solutions not excepted however, which renders the generation and disintegration of tissues possible. The effect of moderate doses of salt is evident both to the chemist and to the clinician. It is also observed that without any more water being taken the kidneys will have a more powerful action, the quantity of urea will be increased, that means the metamorphosis of albumin (about 4.7 in ordinary conditions) is increased in consequence of the increased circulation of the parënychymatous liquor. Of course this circulation bears a relation to the quantity of salt absorbed, large quantities hasten the changes in the albuminates and thereby necessitate additional water. In that way they again increase the urea and carbonic acid discharges. Besides, they excite the surface secretions to an unusual degree. They act not merely as diuretics but also as laxatives. In the *Jour. f. Kinderkr.* for 1873 there is an account of a specimen of mother's milk which contained eight per cent. (!) of salt, thereby endangering the baby through a violent diarrhœa before the cause of its suffering was discovered and removed.

I return to the fact that vegetable diet contains more potassium and less of sodium than milk, and the milk of the herbivores more potassium than that of the carnivores. Cat's milk contains sodium

1. to potassium .76, woman's milk 1. to 1.13-4.4, sheep's and cow's milk 1:5.6. The quantity of salt in woman's milk is influenced greatly by the direct addition of the same to the food. These facts are of great importance in the preparation of an artificial diet whether of vegetables, or of animal milk, designed for the human infant. The addition of salt is not only of great physiological importance, in the interest of tissue changes in general, but without such addition artificial diet is deprived, from the beginning, of the chemical mixture, which renders it quite similar in this respect to the natural. An extremely important fact is also this, that the addition of chloride of sodium delays and renders difficult the firm curdling of the milk by rennet (Pflüger's Arch. XIII p. 93). Thus it ought to be added to cow's milk as a general rule, and to woman's milk when the large curds brought up by vomiting, or evacuated by rectum exhibit an undue amount of coagulation.

ADDITION OF SUGAR TO COWS' MILK.

The quantity of sugar in the milk of the woman, the ass, and the mare, is greater than that in cows' milk. Immediately after the milking, perhaps even before it, the lactic acid change begins, a process which together with the gradual conversion of fat into acids is the cause of the curdling. Its high percentage in woman's milk, with a smaller percentage of casein and butter, gives it its blueish color, and to the colostrum which, besides, is rich in salt, its tendency to produce diarrhœa. Sugar occasionally manifests itself under abnormal conditions. In the milk of anæmic women it is occasionally found to an unusual degree. In that case the other solid matters may be diminished, though this does not always follow. Under such circumstances the infants not unfrequently have obstinate diarrhœa.

The conversion of milk-sugar into lactic acid takes place very rapidly. When this change occurs in cows' milk, it becomes sour at once. Cane-sugar is not so easily transformed. Indeed, cane-sugar is utilized for the purpose of counteracting the rapid conversion of milk-sugar, and the preservation of articles of food in general.

Condensed milk remains intact a long time on account of the addition of cane-sugar in spite of the presence of milk-sugar. Therefore, it is not at all an indifferent matter, *whether milk sugar or cane sugar is*

added to the artificial diet. Still the use of the milk-sugar has been urged upon other grounds. It has been stated that milk-sugar is to be preferred because it contains phosphatic salts, but verily these may be introduced into the body in other and less dangerous ways. Besides, it will be proven in another part of this book, that phosphates are so plentiful in all kinds of foods, that they are eliminated as fast as they are introduced. It has also been said that milk-sugar is contained in milk by virtue of a natural arrangement, and if nature had intended to have cane-sugar in milk, the same nature would have supplied cane-sugar. After all it is a fact, and often a disagreeable one, that milk-sugar is quickly converted into lactic acid, so that an excess of acid accumulates in the stomach, and causes the protein substances to coagulate and become indigestible; it dissolves the alkalies and the calcium out of the phosphate combinations to no purpose except to produce dyspepsia and diarrhœa; it eliminates phosphoric acid before the proper time, and gives rise again to diarrhœa, and, according to Heitzmann and others, to rhachitis. These facts furnish reason enough for carefully *avoiding the use of milk-sugar, and for preferring cane-sugar as an addition to cows' milk* and artificial foods.

Above all, it has long been known that cane-sugar is partially converted into grape-sugar while yet in the stomach. Hoppe-Seyler was willing to recognize this fact, but modified it in this that this conversion takes

place only by the action of the mucus of the stomach, not by the action of pure gastric juice only, and only with the co-operation of saliva. Meanwhile the fact remains indubitable, since Uffelmann observed in the stomach of a boy upon whom gastrostomy had been performed, an abundant immediate conversion of cane-sugar into grape-sugar beginning within forty-five minutes. In accordance with what has been said, I assert that artificial nutriments for children ought to be mixed with *cane-sugar*, *not with milk-sugar*, in view of the active production of acids in the young, their tendency to diarrhœa, and the danger incurred by the premature discharge of salts.

ANIMAL ADMIXTURES.

Human knowledge and foresight have almost exhausted themselves in the efforts of procuring a reliable cow's milk. But the result of all of them is *good cow's milk, and no equivalent for mother's milk.* But do I mean to say that cow's milk, or cow's milk mixed with water, is absolutely poisonous and injurious to babies? Far from it. The undeniable fact that there are infants who thrive on that exclusive diet, or whose general condition remains such as to require no medical or medicinal interferences in their behalf, would give the lie to such an exaggerated opinion. Still, there are a great many infants who *appear* to thrive better than they *actually do*. Many grow fat and rotund on improper food, no immediate harm makes its appearance, and still we find many who, though they increase in weight, lay the foundation gradually to future ailing. For such fatness and rotundity means, too frequently, rhachitis, and requires watching and change of food. However, the number of infants remaining in good condition on that food is not very small. What does it prove? Nothing else but that the digestive processes permit of a certain latitude, that nature does no routine work, and that the sum total of vital processes does not respond to certain influences like reagents in a chemical test, where the same proceeding always yields the same results. There is *no food*, unless quite absurd,

on *which certain infants will not thrive*. But when, in a large percentage of cases, the unfortunate results are established, and when these can be traced to their exact and uniform cause, that particular food is to be condemned. The assertion that cow's milk is an exact substitute for human milk, is the counterpart of that which obtained equality for human and animal blood. The practice, based upon this assumption, and resulting as it did in the transfusion of animal blood into the human circulation, out-lived itself very speedily.*

Such practitioners and authors who convinced themselves of the ill success often attending the use of milk, or watered milk, commenced at an early period to mix it with meat soups, meat tea, or egg. Bretonneau reported as early as 1818 that "*tabes mesenterica*" disappeared in the hospital of Tours from amongst the children fed on beef soup and milk. This mixture Vauquelin declared to come nearest to mother's milk, of all preparations. The administration of some beef soup, well made, a cupfull every day (mutton broth when there is a tendency to diarrhoea), is advisable towards the end of the first year. Long before this period, indeed at any time during infancy, is it indicated in cases of early rhachitis, rhachitical constipation, undue adiposity, and retarded teething.

* Inaugural address, Trans. Med. Society State N. Y., 1882, Medical News, Feb., 1882.

Beef-tea, well made, in the bottle swimming in the waterbath, is still believed by some to be the model food. That it is not so rich in soluble albuminoids as was believed, ought to be generally understood by this time. What, however, it does contain in large quantities, is salts. Thus it is a dangerous article in summer diarrhœa, and must never be administered by itself. When given at all, it ought to be in combination with farinacea, raw albumin (which in this mixture, requires very little salt, if any).

Egg has been utilized as an admixture to milk, or as its substitute in a great many ways. The yolk and the albumin have been so employed. The white of an egg, with a little salt, and six ounces of water, well beaten and shaken, is a good mixture, which can take the place of infant food but temporarily, but is an invaluable make-shift in severe intestinal catarrh, or a permanent nutriment in the same when added to other food. We shall return, however, to that subject.

Falkland skims milk, and transforms it by means of pepsin. The process does not recommend itself to general use by its circumstantiality. Roberts heats milk to nearly a boiling point, and treats it with liquor pancreatis and bicarbonate of sodium. Fairchild's method of peptonizing milk is generally understood all over the country, and is widely appreciated.

OTHER SUBSTITUTES.

Cow's milk, as a universal substitute for mother's milk, has lost its credit with many through the differences in the article; (which, however, as long as no adulterations are perpetrated, are less marked than the same secretion of the human being). If that were not so, how does it happen that all over the civilized world substitutes are sought for, offered, and purchased, though milk be as cheap and handy as anything else? Why is it that to avoid cow's milk, untold risks are run in procuring more expensive, more unknown, and more unreliable vegetable compositions, which seldom keep the promises loudly displayed on the labels? What are these promises? What does it mean when they claim to take the place of mother's milk?

Mother's milk is considered the best prepared article of food known. An ideal article of food must serve two purposes and consist of two classes of constituents. It must, in the infant, supply the growing tissue with material sufficient to take the place of that which is constantly wasted, and to allow a surplus for growth; and, secondly, supply fuel for the purpose of keeping up the production of an equable temperature and the functions of the organs, mainly those of respiration. The first requirement is fulfilled by the proteinous, or albuminous substances, the other by carbo-hydrates. This statement would require modi-

fications, if it were our object here to be absolutely correct, for the two classes will supply each other, act vicariously for each other, even change into each other, under certain circumstances, in the complex machinery of the human system. The albuminous tissue-builder in the milk is mainly caseine, sometimes, also, albumin; the second class is principally represented by fat and sugar. In vegetables the first class is represented in the gluten, the second mainly in the starch. If we add, that in the milk, the ideal food, the proportion of the first class to the second is about 1 to 4, the vegetable substitutes are to be judged, in regard to their mere chemical composition, by that formula of about 1 to 4.

But it is not the chemical formula alone which determines the rank of a substance as a nutriment. To the equivalents of the chemical formula of cow caseine infant mathematics would not object, did not the infant stomach revolt against it. Thus it is not exclusively the chemistry of an article, but its digestibility, which comes into question. Now, not everything is equally digestible for everybody, sick or well, old or young, adult or child, infant or newly born. And particularly is that so with regard to starch, which forms such an overwhelming part in the composition of vegetables, and particularly of those which are mainly used for the purpose of the manufacture of infants' foods.

Starch is changed into sugar and rendered digest-

ible by the secretion of two sets of glands, the salivary glands and the pancreas.

SALIVA.

The function of the saliva is two-fold. First, to lubricate, and second, to transform starch into grape sugar. The latter change is also observed in plants. There is a large quantity of starch in the potatoe, with a very small proportion of the ferment that changes the starch slowly between spring and winter.

The ferment contained in saliva, which contains 99 per cent. of water, acts in the same way.

The three pairs of glands which secrete it, begin to be developed in the second foetal month, are quite noticeable in the third, and then develop rapidly. The parotids, for example, weigh two grammes, (half a drachm) at the age of one month; that is, $\frac{1}{1500}$ part of the weight of the whole body, that is more in proportion than in the adult.

At the age of fifteen months they weigh five grammes, and eight grammes at the age of two years.

Since the time of Bidder and Schmidt, Ritter von Rittershain, Joerg, and myself in "Dentition and its Derangements" published in New York, 1862, a great many experiments have been made with reference to the formation of sugar by the action of saliva.

Schiffer experimented upon babies at the age of two hours, sixteen days, and two months, and in every instance he found, as the result of the action of saliva on starch, sugar by Trommer's method.

Korowin made infusions of pancreas and of par-

otids, added starch, and the result was that the pancreatic infusion changed starch at a later period than did the infusion of the parotids. In his experiments the pancreas did not change starch in the first month, only slightly in the second, but noticeably in the third month.

The infusion of the parotids, however, was efficient in the first few days of life, particularly in infants of large size and well developed. The effect increased visibly towards the end of the first month, and the quantity of secretion increased to such an extent, that he could collect a cubic centimeter (fifteen minims), within five or seven minutes in the fourth month of life.

The saliva of seventeen babies, at the age of from one to ten days exhibited the same diastatic power. A number of these babies remained under observation a long time, so that no mistake could be made. The number of his quantitative analyses amounted to one hundred and twenty. When he compared the diastatic effect of the saliva of a baby eleven months old with that produced by his own, he found that it was the same from the same quantity.

Since his first observations Korowin has gone over the same subject, and has given the results in the *Jahrbuch f. Kinderh.* 1875, p. 381; they are as follows: It is possible to collect the secretion of the oral cavity in babies a few days old. Still there is some difficulty in gathering saliva before the age

of six weeks. The quantity of this secretion increases towards the end of the second month, and this augments with every month. The secretion is almost always acid, unless the oral cavity is carefully cleansed. After it has been washed out, it is slightly acid, or slightly alkaline, or simply neutral.

From the very first month of life a distinct diastatic effect is produced by the oral secretion, and this increases with every month.

Infusions of the parotids, prepared at different times after death, produce the same effect. Infusions of the pancreas, within the first three weeks of life have not produced any change; its diastatic effect begins with the fourth week, and remains feeble up to the end of the first year.

Zweifel has made a number of observations, and given the following conclusions. The infusion of the submaxillary glands of the infant do not transform starch into sugar even when it has been exposed to the influence of the infusion for one hour. The effect of the infusion of the parotid of a baby seven days old was distinct after four minutes exposure; that of the parotid of a baby that died of gastro-enteritis at the age of eighteen days, did not show itself until after the lapse of three-quarters of an hour.

There was no effect produced by a similar infusion made from the parotids of a child prematurely born, from one that died of diarrhœa and debility,

from a foetus in the third month, from a foetus in the fourth month.

An infusion of the submaxillary glands of a foetus in the ninth month of utero-gestation produced no effect upon starch. The parotids of the same foetus produced a change after three-fourths of an hour.

It is a remarkable fact that different varieties of starch are not changed into grape-sugar in the same length of time. Solera found that the transformation of the starch of the potatoe was the most rapid; next was the starch of Indian corn, then that of wheat, and the change of the starch of rice was the slowest. The same results were obtained by Malay.

Raw starch changes slowly; boiled starch quickly. According to him the starch of potatoe required from two to four hours; that of peas from one and three-fourths to two hours; that of wheat one-half to one hour; of barley, ten to fifteen minutes; of oats, five to seven minutes; of rye, three to six minutes; of potatoe paste, five minutes.

It is important to know that *the effect produced by the saliva persists in the stomach*, although this effect ceases within two hours.

It ceases altogether, and the starch will not be changed in the stomach as soon as the secretion of hydrochloric acid has begun in the digestive process. This is a very important fact, because it shows that *the infant food, although it is not masticated and passes*

the mouth very rapidly, is still under the influence of the saliva in the stomach.

Hydrochloric acid is not secreted at once. The first acids in the stomach while digestion is going on, are of an organic nature, the lactic (and sometimes the butyric). Thus it is that when gastric juice is removed from the normal stomach, it contains organic acids only. So also, there is no free hydrochloric acid during digestion, for instance, in fever, a considerable amount of catarrh, or in dilatation of the stomach when the pylorus is constricted. In that condition amylacea are taken to advantage, principally because the diastatic effect of the saliva is not disturbed.

In a gastrostomized boy, Uffelmann found that while there was no fever, there was lactic acid only in the stomach and no hydrochloric acid, during the first half hour of digestion; afterwards, hydrochloric acid was found.

Some starch is digested at the very earliest age. If there be a moderate surplus, it is expelled like the surplus fat in normal woman's milk, without annoyance or injury. Besides being nutritious, to a certain degree, and in its peculiar way, it serves to dilute cow's milk, to reduce its percentage in casein, to prevent the latter from coagulating in large masses, and thus to render it digestible. To accomplish all this, no large quantity is required. Thus those cereals and farinacea are to be preferred, which contain a small

proportion of starch, and a large one of protein, or those substances (gum arabic, gelatine) which, while serving the above indications, are also nutritious. Of cereals belonging to the former class, I prefer barley, and oatmeal. Thus the number of available articles is by no means small. They all come up to the requirements we look for in such substances. They must be, to be of *universal* usefulness to the rich and poor, perfectly simple and recognizable. *They must be accessible, and for sale everywhere. The mode of their preparation must be perfectly simple and easy. They must be cheap.*

These requirements are not always fulfilled by the artificial foods offered for sale. I cannot help referring to them again, though my doing so before has not increased the number of my friends, and one of these at least, who felt offended and injured because he did not think I included him amongst the honest and gentlemen amongst the advertising manufacturers, threatened me with a law suit.

The community insists, with the utmost pertinacity, upon giving their babies, as soon as weaning time arrives, or before, such articles of food as they know nothing about. When an adult sits down to a meal and finds placed before him articles of food with which he is not familiar, he makes inquiries in regard to such articles before eating them. The baby, however, is credulously fed upon things with which the child, father, mother, or doctor has not the least

familiarity; of these foods most which are sold in large quantities, have a composition which is unknown to the public. When some manufacturers deign to say anything about their merchandise, it is to the effect that the food offered is the best in the market, that it is the proper thing and the only thing for children and invalids of all ages, that the relation of the albuminous substances to carbo-hydrates is exactly correct, and that a package costs a certain amount of money. In regard to this subject the public appear to be smitten with absolute blindness. They insist upon forgetting that the man who offers for sale, and advertises at a very heavy expense, does so, as society is constituted, for his pecuniary advantage. To say that when the article offered is not good, it will find no market, is deceiving ourselves, experimenting on our babies, relying on the character of a single man or corporation, on the honesty or intelligence of the manufacturer's chemist, or his superintendent, or his workmen, on the nature and condition of the elements used in the composition of the article, and on ever so many influences, which can work before the manufactured article gets into the hands of the consumer. Why the sellers and advertisers of unknown compounds should be more trusted than those who sell a simple article of food, such as milk, which is constantly adulterated, can hardly be perceived. Is it necessary to say that the factory furnace is lighted more in the interest of the proprietor than for the benefit of the public?

Still, in regard to the growing evil, which has assumed vast proportions, the profession is at fault, to a certain extent. There are but few but are aware of the inexpediency and sometimes danger attending the exclusive feeding of cow's milk, and look for substitutes. Examples of infants thriving on almost any food are numerous; the public taste runs in the direction of the unknown; thus the responsibility of advice or assent is but a slight one; many of the foods in the market come in a pleasant form and convenient for use; thus the food business firm thrives. Professional men have come to look upon the use of patented foods as something quite unobjectionable. Those imbued with the strictest sense of ethics, who would not patent an invention, nor tolerate the fellowship of a professional man who does so, who frown upon patented medicines, because they are unknown and unknowable compounds, or though their components be printed on the labels, these very men forget their habits and principles when the question of patent-right and secrecy comes up in regard to foods. If I add, that many of the scientific journals of Europe, particularly those of Germany, dedicated to the study of children's diseases, are frequently used for the purpose of discussing the merits and effects of some new infants' foods, it is only to show to what extent the evil has grown.

No profound thinking is required to appreciate the fact that of a great many of the articles offered

for sale a few only are available compositions. But the very fact that they are compositions, that everything organic may spoil, that every compound depends on too many circumstances which are apt to interfere with its uniform condition, and that when we rely on a compound, we rely at the same time on a proprietor, his foreman, his workman, his chemist, and the wholesale or retail dealer, we feel that we are easily deceived or disappointed. Besides, for an article, the constituents of which we can purchase at a low price, we are taxed to an inordinate extent. I repeat what I often said before: artificial foods must be simple, recognizable, accessible, cheap, and easy to prepare. Thus only will they become universally useful to the rich and poor, to city, country, prairie and backwoods.

BARLEY AND OATMEAL.

Oat-meal has been a preferred article, and has long enjoyed the recommendation of authors as a proper substance for children's food. Van Swieten praises it in exceptionally high terms, and T. Herbert Barker placed it at the head of articles of diet twenty years ago. "In placing oat-meal gruel at the head of the list of farinaceous foods, I am guided by my own observation of its utility. Such, indeed, is my confidence in its value, that if I were restricted to the use of any one article in addition to milk for bringing up a child, it should be this." *

I have always preferred barley-meal, when an article for a steady diet was to be recommended, for the reason that oat-meal, on account of its containing fat and mucin, tends to relax the intestines sooner than barley-meal. Otherwise, the chemical composition of both is so nearly alike, that it would make but little difference upon which the choice would fall.

* If bad associates were to bring harm to a good cause, I ought not to quote Mrs. Baines, who insists upon the use of farinaceous foods, together with other articles of diet, on the ground that because the foods of man and beast are dissimilar, the milk must participate in this dissimilarity. "When this idea is completely understood, and this great fact in natural history is recognized, then, for the first, will one understand the utility in mixing vegetables with cow's milk given to children as their regular diet."

Meanwhile, there is no danger so common for little children as that which occurs on account of their tendency to diarrhœa. My advice in this matter, once for all, is to give barley-meal to children who have a tendency to diarrhœa, and oat-meal to those who have a tendency to constipation, and to substitute occasionally the one for the other, as changes occur in the performance of the functions of the intestinal tract. One more observation may be made at this juncture—though it be referred to in another part of this book—on account of its practical importance, namely, that diarrhœa and a milk diet are not compatible, that, therefore, when barley-meal must be given on account of diarrhœa, it is advisable to lessen the quantity of milk at once, or to suspend it entirely for a time. In that case the white of egg, either with or without brandy, must take the place of the milk. This plan has led me safely over many a danger in the past thirty years, and has saved the lives of many children. It has given me great pleasure to see the success which K. Demme (*Dreizehnter Jahresbericht*, 1876), Hennig, and others since, have had by following a similar plan. In my book upon “*Infant Diet*” I have made the assertion that it is a matter of indifference whether you use for children the barley corns with the husks retained, or the smaller pearl barley with the husks removed. That statement is erroneous. I had been misled to the opinion that protein bodies and starch are uniformly distributed in the barley. In

point of fact, the relation is such as is found in the other grains, that is to say, by far the greater part of the gluten is collected in and under the superficial coverings. According to Enzinger's publications, the meal granule of the barley-corn, which lies next to the layer covering the seed, is composed of large irregular cells which are filled with albuminoid corpuscles, and yield no starch.¹

Further inward are found large irregular quadrangular cells, which yield albumin and an abundance of starch. Still further in the interior are yet larger cells which are filled almost exclusively with starch. The consequence of all this is that the entire kernel, and not the interior alone, is to be used for food for children. That which is found in the shops as "prepared barley-flour" for convenient use, is fine and white; these are two suspicious qualities. The less the meal possesses of the yellow outer layer, which contains gluten, the less reliable is it. Likewise, the

¹ "The husk covering the corn, the so-called chaff, is composed of small cells with thick walls, whose membrane is thick and dry and imbibe water with difficulty. This imbibition is still less active on account of a deposit of fat.

The yellow color depends upon a deposit of extractive matter.

The chaff is developed at the end of the kernel, together with the basal-chink, at the point where the germ of the root usually springs forth.

The basal-chink forces an opening at this point into the interior of the kernel by means of runners, which seem very

price of this refined article is fixed at so high a point, that the pretense of its so-called purification is paid for at a good round sum. I advise therefore in all cases, that people grind the barley to be used for children's food as finely as possible in a coffee-mill reserved for that purpose, in order to shorten the time necessary for boiling it, and thus to save the gluten. In the case of very small children it will pay well to allow the barley to boil for hours, in order to let the outer layers burst, and void their contents, as in this way the largest part of the starchy matters in the centre will be got rid of by straining the decoction. It is always a good plan to grind the kernels as already recommended, and not to make use of the pearl barley, which is the inner kernel freed from the husk.

The fact that the outer layers of the cereals are so much more nutritious than the inner portion of the grain, has been ably utilized by the "Bread Reform League," whose headquarters is in 8 Northumberland

similar to capillaries, develop in an inward direction, and possess a great power of imbibition. A second covering is the so-called fruit-shell, which has no layer of condensed material, and consequently has great power of imbibition. It lies in a plane parallel with and interior to the chaff, and is interrupted only at the point where the germ must spring forth. A third layer is the seed-shell bent inwardly from the fruit-shell, probably as the decidua is represented to be turned back from the uterine wall." Lorenz Enzinger, *Die Anatomie des Gerstenkornes* Leipzig 1876.

Terrace, Regent's Park, London, and whose Hon. Secretary is Miss Mary Yates. Besides by a large number of persons in the high walks of society, it is sustained by quite an array of renowned medical men, such as W. B. Carpenter, Horace Dobell, J. E. Erichsen, R. Farquharson, Charles J. Hare, F. W. Pavy, J. Russell Reynolds, B. W. Richardson, Sir Thomas Watson, Sir Erasmus Wilson, Charles Cyril Hicks and Morell Mackenzie. The Bread Reform League has been founded for the purpose of supplying the poor with a kind of bread at least as digestible as, and much more nutritious than, the white wheat bread in common use. It is claimed, and the claim is substantiated, that

“Millers reject, in the manufacture of white flour, from 20 to 25 per cent. of the most valuable part of the grain. England would, therefore, be less dependent on foreign supplies if wheat-meal bread were generally adopted.

“White bread alone will not sustain life. Dogs fed on white bread died at the end of forty days, whilst those fed on wheat bread alone throve and flourished.

“White bread is not only deprived of a portion of the flesh-forming substances of wheat, and nearly all those materials required to form bones and teeth, and nourish the brain and nerves; but also of the natural stimulant contained in the embryo and outer portions of the grain, which assist and stimulate digestion.

“ Especial attention is directed to the fact that the Blue Book of 1878, after describing the advantages of wheat-meal bread, says: ‘ It should be more generally known that bad, indigestible bread, devoid of flavor and nutriment, begets a craving for stimulants.’

“ Much of the misery endured by the poor (especially amongst children), from the use of insufficient food, would be prevented if they could be induced to adopt a bread which is not only more nourishing, but should also be considerably cheaper. As much nourishment can be obtained from 3d. worth of wheat-meal bread, as from 4d. of white bread, a saving of 25 per cent., in addition to improved health and diminished butchers’ bills.”

Undoubtedly, the Bread Reform League is working on the basis of a sound hygienic doctrine. The example given by it can be imitated everywhere, the chemical facts referred to are easily understood by the most simple minded, and can be made the common property of both individuals and societies.

The practical common sense of the Bread Reform League cannot be too much praised. I wish we had as much circumspection and wisdom in our country. When a committee appointed by the Medical Society of the State of New York to co-operate with the New York Society for the Prevention of Cruelty to Children reported in favor of the public sale to the infants and children of the poor, at cost price, the necessary

limited quantities of powdered barley, powdered oatmeal, sugar, milk, and eggs, the report was printed in the next annual report of the Society, and commented upon with high praise, *and shelved*.

For children who have passed the first few months of life, the pearl barley answers fairly well with its large quantity of starch. It remains to be remarked that in large cities the simplest crude materials are only to be had by special inquiry for them. Now, by the addition of barley or oat meal to the milk which has been previously prepared in a proper manner, I expect more than a mechanical dilution, because when Moleschott declares that thirty-six ounces of barley-meal are sufficient for the daily fare of a full-grown laborer, the addition of from ten to twenty-five grammes (two to six drachms) of the same material means no insignificant increase in the diet of a child. C. Voit has recently made the needs of children in the way of nourishment at particular periods of life the subject of a searching investigation (Ub. d. Kost in öffentl. Anstalten. Z. f. Biol., xii 1, 1876). More recently Sèixler (Ernährungsbilanz der Schweiz, p. 6) has calculated the relation of the ingredients of food proper for children up to the age of fifteen years with the result that the following allowance should be made:

Albumin, 78 gm.

Fat, 20 gm.

Carbo-hydrates, 250 gm.

Nitrogenous substances: Carbo hydrates 1:3.8.

Hildesheim calculated for children of from six to ten years:

Albumin, 69 gm.

Fat, 21 gm.

Carbo-hydrates, 210 gm. (1:3.6).

In the orphan asylum at Munich, where the children present a good appearance upon a mixed intellectual and physical supply, Voit calculated for their diet:

Albumin, 79 gm.

Fat, 35 gm.

Carbo-hydrates, 251 gm. (1:3.9).

Finally, he makes a careful calculation in which the requirements of a child are compared with those of a grown person, at rest or at work.

A child of 10-11 years, weighing 23 kilos (46 pounds):

Albumin, 79 gm.

Fat, 35 gm.

Carbo-hydrates, 251 gm. (1:3.9).

The laborer of 60 kilos (125 pounds) averages:

Albumin, 118 gm.

Fat, 56 gm.

Carbo hydrates, 500 gm. (1:5).

The laborer of 60 kilos, while at work:

Albumin, 137 gm.

Fat, 173 gm.

Carbo-hydrates, 352 gm. (1:4.7).

During rest:

	Alb.	Fat.	Carbo-h.
1000 kilos in a child.....	343	152	1091
1000 kilos in an adult.....	228	120	586

Thus it follows that a child of a given weight, who, at the same time must keep up his tissue changes, and must supply albumin, fat, and ash residues, requires absolutely more of the important elements than the adult in the same condition of comparative rest. Albumin to the extent of 50 per cent., fat 25 per cent., carbo-hydrates about 100 per cent., are demanded by the child, under the above circumstances, in excess of that required by an adult. The substances containing these elements must not only be received, they must be taken in a digestible and assimilable form by the young child, and in the same or nearly the same proportion which they hold in the mother's milk, in which the relation of the nitrogenous to the non-nitrogenous elements is as 1:2.7. Where it is possible this relation must be sustained.

J. Foster has given the following table of relative requisites:

Age.	Food.	Alb.	Fat.	Carbo-h.	Proportion.
7 weeks..	Gruel....	29...	19...	120...	1:5.3
4-5 months.	Milk.....	21...	18...	98...	1:6.1
1½ years..	Mixed...	36...	27...	150...	1:5.4

Without doubt the above proportion of 1:6.1 is to be attributed to the considerable quantity of sugar in the milk. To what point this element is use-

ful, indifferent, or harmful, has already been alluded to, in part, but must be still further elucidated. It will be shown that under certain circumstances it may be useful, is occasionally harmful, and seldom quite indifferent. It is too soluble, too readily absorbed, too easily changed to be quite indifferent. In this respect it is quite different from a small quantity of starch, which may pass through the intestine without being changed or working any appreciable changes. Indeed the intestines of children have to pass every day some of the natural food, that is, mother's milk, or some parts of it (principally fat) without any change.

Still I emphasize the fact alluded to in my explanation of the functions of the salivary glands, that additions to the milk diet during the first few months of life must not contain too large a percentage of starch, while at a later period it is not necessary to be over-particular in regard to the same. I have therefore stated that the barley-gruel which is given to very young children, should be prepared from the crude barley-corns, because the greater quantity of protein material is contained in their outer layer.

E. Wolff has called attention to an important fact in reference to the nourishment of animals used for labor upon the farms, viz: that the feeding of an easily digestible protein results in no real change in the digestible properties of the rest of the food, but that a considerable addition of carbo-hydrates accomplishes a greater or less depressing effect in the digestion of the other food.

Thus, if we be justified in using the results of these experiments upon animals, the quantity of starchy material which is to be mixed with the food must not be too great. Nor is it proper to select farinacea at random; in this respect many mistakes have been made even by eminent writers. Thus, for example, while I can only approve of Soltmann's recommendation to use gum arabic for the purpose I have mentioned, I am compelled to doubt Pepper's recommendation which approves of gelatin, and arrow-root, in order to facilitate the separation of the coagulated casein. They are by no means equivalent. Just as little can I accord with the recommendation of Eustace Smith who employs for the same purpose indifferently, arrow-root, sturgeon's bladder or gelatin substances which are quite unlike each other. The bad results which he must have seen from this lack of discrimination, form very good reasons why he should recommend the frequent use of carminatives. In "The Sanitary Care of Children and Their Diseases, being a series of five essays by Drs. Eliz, Garrett-Anderson, S. C. Busey, A. Jacobi, J. Forsyth Meigs, and J. Lewis Smith, prepared by request of the trustees of the Thomas Wilson Sanitarium of Baltimore, Md.," Boston, 1881, Sam. C. Busey says "Notwithstanding the protest of Jacobi against the use of rice-water, the experience of the writer coincides with that of Trousseau in regard to its value. We have too often witness-

ed its beneficial effects in cases of diarrhœa with uncontrollable vomiting in young infants, to abandon its employment on mere theoretical grounds." This objection is not to the point, for I am not now, nor was I then, dealing with pathological conditions and therapeutical indications, but only with the consideration of farinaceous foods under normal circumstances, and for the purpose of a regular diet.

GUM ARABIC AND GELATINE AS ADDITIONS TO MILK.

Until within a short time gum arabic was not considered nutritious. Frerichs, Lehmann, Husemann, will not admit that any change takes place in it. Gorup-Besaney says that it is dissolved but not digested. Mixed with milk it was presumed to act only in a mechanical manner. Some years ago, however, Uffelmann experimented upon a boy with a gastric fistula, with a solution containing eighteen parts of gum in two hundred parts of water, and made direct observations. This solution, introduced directly into the stomach, yielded after a while, without the presence of saliva, a trace of grape sugar. Fifteen grammes of the gum yielded in forty-five minutes a twentieth part of a gramme of grape sugar. Thirty grammes in sixteen minutes yielded twenty-eight one-hundredths of a gramme (0.28) of grape sugar. The latter mixture had quite an acid reaction; it was not decided whether the acid had already existed for some time in the stomach, or was only developed with the introduction of the gum. In both cases the presence of hydrochloric acid and conversion into grape sugar seem to go hand in hand. Probably the addition of some hydrochloric acid will recommend itself in practice, if the object is not only to obtain the mechanical effect of the gum, but also its final changes. Milk, also, when it is to be administered with the gum arabic,

bears the admixture of muriatic acid quite well, if it be remembered, what I said of J. Rudisch's plan to render milk more digestible by mixing it with water and muriatic acid.

In reference to gelatine as an addition to milk there are two indications. Some lay most stress on its mechanical action in distributing the elements of the milk in the same way that this is brought about by additions of gum and farinacea. Others insist upon probable usefulness in effecting tissue changes. Guérard quotes Jean de Sery, who expressed himself in the following manner: "Having tried what skins and parchment are fit for in case of necessity, if I had buff jerkins, clothes of chamois leather, and such other things as contain sugar and moisture, and were confined in a fortress, for a good cause, I should not desire to escape from fear of hunger." In the same way Denis Papin is said to have made an offer to Charles II (*La manière d'amollir les os*. Paris, 1682) to prepare for him, out of bones, for use in poorhouses and hospitals "a quintal and a half of gelatin, by means of eleven pounds of charcoal," a promise which he was not called upon to fulfill, because a facetious courtier hung about the neck of his hound a placard bearing the petition "do not rob me of my bones." In a similar manner D'Arcet promised to make five oxen out of four, by utilizing the gelatine.

Guérard compared a large number of reports made for the French Academy and others and came

to the conclusion that gelatine is very nourishing, in the first place; secondly, that on account of its probable importance for the cellular tissue it is absolutely necessary for the maintenance of life.

Voit experimented for nine days on a dog which was fed upon gelatine. He found conclusively that gelatine does not build up the body, and is not deposited as a gelatine-yielding tissue (Guérard's opinion), but is readily decomposed and broken up in the place of the circulating albumen, which is thereby protected and saved. In this way it saves as well the circulating as the organized albumin, and accomplishes the same results as the carbo-hydrates and the fats, only to a more intense degree. In opposition to these assertions of Voit, Tatarinoff comes to the conclusion that it is never possible to prevent a diminution of the weight of the body when an exclusive diet of gelatine was administered. The quantity of nitrogen which was discharged in the form of urea, in the experiments he made, was always greater than that which existed in the gelatine consumed. The loss of weight during a gelatin diet was materially less, however, than in complete starvation, when diarrhoea and bloody urination could be avoided. When starch, fat, extract of meat, and water were combined with meat or gelatine, it could be shown that the weight of the body increased with the former and diminished with the latter. Furthermore, the quantity of urea which was discharged after the above diet had been

prescribed was much less with the addition of meat than with the addition of gelatine. The nitrogen in the urea, after the addition of gelatine, was absolutely more in volume than that contained in the gelatine itself, while the meat contained a greater volume of nitrogen than was discharged. Hence it appears that the nutritious value of gelatine is much inferior to that of meat, but the addition of gelatine result in a smaller loss to the body, in a mixed diet of starch, fat, meat extract and water, than occurred without such addition. Likewise it was evident that the other ingesta were more completely digested, and that a smaller quantity of excrementitious matter was discharged when the gelatine was added than when it was omitted.

Gastric juice (but not the acid portion alone) so alters gelatine that it no longer gelatinizes. The whole question, however, appears to have been finally answered by Uffelman. Upon his patient with gastric fistula, first when in a condition of fever, then without fever, he found by direct observation that gelatine is actually dissolved. Within an hour it is so modified that it no longer holds together, and it is easily diffused. Artificial gastric juice, however, required from eighteen to twenty hours to accomplish the same end. No bad odor was developed any more than in ordinary stomach digestion. However, grape-sugar, which is occasionally found in ordinary gastric digestion of gelatine, was not observed. Thus, gelatine is easily digested, but readily decomposed, and re-

quires the addition of hydrochloric acid. This latter observation is of great practical importance, for in acute and debilitating diseases, the secretion of pepsin and of hydrochloric acid is diminished. There is no doubt, therefore, as to the utility of gum-arabic and gelatine, as an addition to cow's milk and to children's diet. Not only do they fulfill the indication of diminishing and distributing the particles in cow's milk, but they also officiate as a means of direct nourishment by preventing waste. Furthermore, they are satisfactory articles, inasmuch as they are simple materials which can be obtained everywhere, are out of reach of the patent medicine line, and cheap, and easily handled. Simple boiling suffices to produce a solution.

HOW TO FEED.

How should little children be fed, from a spoon, from a cup, or from a nursing bottle? Most certainly from the latter. It alone gives the certainty, that the food has a suitable consistency and contains no lumpy ingredients. The accurate removal of lumps and a uniform consistency of the food is analogous, in the child, to mastication in the adult, at least this is approximately true. The prejudice which is prevalent with mothers and many nurses, that thick nourishment is necessarily nutritious, must be met and opposed energetically. Proper digestion demands, above all, a gradual introduction of the food into the stomach. The gradual secretion of the gastric juice must correspond with a gradual filling of the stomach. The use of the bottle is so much the more indicated, as well as desirable, in that when a slight degree of weariness comes on after its use, the infant is naturally obliged to cease nursing. Especially is this an important point, when cow's milk and other thickened nourishment is used. A common clinical experience, even with grown people, is that they will not endure milk, so long as they drink it rapidly, but that they have no trouble when they can take it with a spoon, slowly. Besides the act of sucking, in itself, excites peristaltic action, and secretion of the digestive fluids (Spallanzani, Brown-Séquard.) The digestive canal is a continuous tract,

the sucking action excites the function of the salivary glands, and arouses that of the others. When Th. Ballard wrote his book on the diseases of women and children, thirty years ago, in which he proposed to show that almost all the diseases of children, and a good part of those of women, were the results of fruitless sucking at empty breasts, or empty bottles, he was naturally laughed at for his overstatements. But he was influenced by a physiological hypothesis, and by some clinical experience.

In reference to the handling and cleansing of nursing bottles the greatest care must be observed. Even before the bottle is filled, the nourishment, especially if it be milk, is exposed to decomposing changes. The residue which remains in the bottle and upon the mouth piece, especially if composed of india-rubber, ferments very quickly, and for that reason is apt to be dangerous. There is but little difference as to the kind of nursing bottle used. If people are disposed to be pains-taking and cleanly, even complicated nursing bottles will be kept clean, but those who are careless will evince their disposition with even the simplest form of bottle. That kind is recommended which has a rubber tubing from 16 to 20 centimetres long, between the bottle and the mouth-piece. This kind has also a glass tube united to the rubber one and extending nearly to the bottom of the bottle.

There are also "biberons pompes" of which

Prof. C. Soltmann has sent me specimens years ago. In these a hollow rubber ball is introduced low down in the glass tube, whose end projecting out of the tube, by an oblique slit which is made through half of the ball, is converted into a valve. By simple pressure upon the mouthpiece, with the finger, the current appears in jets. Since I gave the first description of the apparatus, the instrument being already in use in France, Soltman has made improvements in it, and I myself have made it accessible to American readers, through an article in Buck's "Hygiene" (New York 1879). In many cases it has done good service. As a rule no difficulties in sucking can come to a healthy and well developed child, yet there are causes of many kinds which may render it difficult or impossible. Immature and sickly babies, or those with cleft palate do quite well with this self acting nursing bottle, from which the contents are sent into the mouth by the very slightest pressure of the mouth piece.

How often ought a child to get nourishment? The proper number of times for nursing is very differently estimated. Natalis Guillot, who introduced the method of systematical *weighing*, for the purpose of determining the influence of nourishment upon weight, advised 20 to 25 nursings daily of perhaps 25 grammes breast milk each time. Bouchaud reduced this estimate to 8 to 10. On the first day of life each nursing was to consist of three grammes of milk, on

the second of 15, on the third of 40, on the fourth of 55. According to his opinion, the first day called for 30 grammes, the second for 180, the third for 450, the fourth for 550, every day of the second month for 650, of the fourth for 750, of the fifth for 850, of the sixth until the ninth for 950 grammes. Ahlfeld allows five nursings daily to a child from four to eight weeks of age, afterward five or four. Fleischmann approves of ten or eleven. According to my experience the newborn infant should be nursed from eight to ten times daily; after it is four months old, five daily nursings will suffice.

Practically it is not very difficult to regulate the quantity of nourishment taken. Healthy children will fix the proper limits themselves. The same rule will apply, with slight differences, in an equally good condition of health, for the nourishment artificially prepared. But it is impossible to lay down as an uniform rule, that some particular quantity must be considered as normal for all children. Ahlfeld calculated 104 grammes at a nursing for the fourth week (the minimum being 50, the maximum 140), in the tenth week 164 (min. 110, max. 225), in the twentieth 212 (min. 100, max. 325), in the thirtieth 263 (min. 85, max. 350).

All such calculations count merely as results of experience, not as infallible rules. The child ought to drink from the breast or the bottle until it has had enough. It takes 20 to 25 minutes to empty one or

both breasts. After having nursed the infant should be quiet, should play with its arms, should breathe somewhat more regularly than usual, or go to sleep. If it be not allowed to have absolute rest, if it be rocked, allowed to lie on its belly, or be carried around, lying face downward upon the hand of the person carrying it, vomiting will be provoked. The facts which have been introduced show that nature requires *play-room*, even the most careful measurements may be incorrect. Thus, for instance, Fleischmann carefully inflated the stomach of a child four weeks old, under a pressure of fourteen centimetres, having dried and varnished it. He found that its capacity was eighty cubic centimetres. He also treated the stomach of a child two months old in the same manner, and found its capacity to be one hundred and forty cubic centimetres. "Accordingly" the quantity of milk to be taken at each nursing must amount from eighty to one hundred and forty grammes. In the same way he found the capacity at the seventh and ninth months to be one hundred and sixty and one hundred and eighty grammes. Is there anything which can be more "accurate and correct?" On the other hand, Ahlfeld found by weighing that the proper quantities were 200 to 210 grammes, instead of 140, or and 200 to 300, (even 350 to 400) instead of 160 to 180 grammes, and concluded that Fleischmann had either made a mistake or had treated the subject to no purpose.

Can anything be more "accurate" than weighing or more absolute than the result so obtained? Both investigators were right in their direct results, and wrong in their conclusions. Both forgot that the nursing, which occupies a child 15 or 30 minutes, represents no invariable quantity, and that the whole quantity cannot be found, at any time, entirely in the stomach. Apart from the elasticity of the living organ, in comparison with the dried and prepared one, it must be borne in mind that rapid absorption takes place in the former from the moment of the reception of food. Hence, an infant with an apparent stomach capacity of 80 to 140 cubic centimetres can just as readily take up 200 grammes of fluid food, as an adult can dispose of 1,000 grammes within half an hour, if he desires.

NOURISHMENT DURING THE PERIOD SUCCEEDING INFANCY.

In the course of the second half year some changes may be made in infants' diet. In the relation of the barley preparation to the milk a change should be made, the milk may exceed its former quantity, and in the same proportion in which the children are permitted and accustomed to drink pure water, the food may become more condensed. Towards the end of the first year, the quantity of barley or oat-meal to be used in the decoction may be increased. It is soon enough to begin the use of pure milk in the third half year, if at all. About the eighth or the tenth month the chewing of a crust of bread, or of a piece of "zwieback" may be allowed. About this time, too, the daily allowance of meat soup may be increased to 250 grammes, and in addition one or two teaspoonfuls of broiled beef may be given. These articles distributed through four, or perhaps five meals, will be sufficient for the greater part of the second year. The quantity may be gradually increased, but a more radical change is useless. If a child which is healthy, and is not spoiled, awakens at night, it needs and desires nothing but a drink of water, or of thin barley water without milk.

About the middle of the second year when the child begins to use a spoon, the breakfast may be made up of more solid elements than heretofore, bar

ley broth or oatmeal mush, thoroughly cooked, an egg, a glass of milk, a piece of stale bread with or without butter. The child must be taught never to drink milk in haste. It will be digested better when time is taken. The daily quantity of meat, preferably beef, to which gradually may be added lamb or chicken, may now be increased to 100 grammes, and this is to be at two or three meals. The evening meal must be similar to that of the morning, and lighter than the midday meal. Neither at this age, nor later, should nervines, stimulants, condiments, course vegetables or salads, coffee, tea, wine, beer, play any part in children's diet. A piece of sugar after a meal which is frugal, but rich in albuminoids, will prove an agreeable and useful addition. Children from two to three years of age, will get along well on four meals daily. Those who are a little older, may do with three, provided they get once a day between meals a piece of bread and a drink of milk, made agreeable and more digestible by the addition of a little salt. Before children are two years of age no vegetables in any quantity should be given to them. Small quantities may be given later on; they will be acceptable and be readily digested. As age advances, the diet should approximate, more and more, that of grown people. Altogether there is no easier, and no more grateful task than that which consists in accustoming children to a simple diet, and to shape their habits and their demands into harmony with

those of nature, from the first year of life. Thus only a prosperous development, both moral and physical, can be expected. C. v Voit (Unters. d. Kost. in einigen öffentl. Anstalten in München 1877) estimates the daily quantity of food required, as

Albumin, 79 grammes;
Fats, 37 grammes,
Carbo. h. 247=Nitrogenous: Non-nitrogenous=1:4.

J. Foster estimated for a well nourished child of one and a half years.

Albumin, 36 grammes,
Fats, 37 grammes,
Carbo h. 151=nitrogenous: non-nitrogenous=1:5 4

Th. Riedel estimated for a public institution at Berlin.

Albumin, 74,
Fats, 18,
Carbo h. 433=nitrogenous: non-nitrogenous=1:6.3.

This resulted in a weakness of muscular structure throughout.

Koenig proposes for children of 6-17 years the following:

	GRAMMES.	ALBUMIN.	FATS.	CARBO-H.
Raw meat	170	30	1.2	0.
Bread	300	19.5	1.	150.
Potatoes	180	3.	0.4	36.
Fat	25	....	25.	....
Milk	250	8.5	9.	12.
Flour	100	10.	1.	74.
Vegetables	180	7.	1.	9.
		<hr/> 78.	<hr/> 38.5	<hr/> 281.

The above corresponds also with the following bill of fare: Raw meat, 100 grammes; cheese, 2.5; bread 300; potatoes, 180; fat, 20; milk, 250; flour, 100; vegetables, 180.

Or the following:

Eggs, 2=100 grammes; peas or beans, 100; bread, 250; potatoes, 180; fat, 25; flour, 100; vegetables, 180; milk, 150; beer, 150, and in addition: coffee, tea, and condiments which contain but a minimum of nutritious substances.

THE MOUTH.

The general nutrition of infants is affected considerably by malformations of the mouth. Most of them are very liable to render nursing difficult, and may prevent it altogether. Sometimes babies are so feeble that it is impossible for them to suck their own mother, especially when she is a primipara, though they may be able to take the breast of a wet-nurse when she is a multipara.

Small hare-lip, when uncomplicated with fissure of the palate or maxillary process, prevents sucking only when the babies are very feeble. Hare-lips, which are complicated with fissure of the palate, always prevent sucking. In the former the soft palate, as a rule, is not fissured.

An undue length of the soft palate does not prevent sucking to such an extent as does shortness. When it is too short a vacuum cannot be formed.

A single time have I seen a soft palate in an idiotic boy, which was immovable and transparent. It lacked its muscular layer entirely, and deglutition and articulation were very deficient. For very many months the effort had been made to teach this boy to articulate, and this had been done without once examining the mouth.

Small defects in the hard palate and large defects in the soft palate are impediments to sucking.

Along the median raphe of the palate there are

in almost every new-born child, small dots, white, elevated, and found in clusters. They have been described by Bohn as sebaceous follicles, but found by Epstein to consist of nothing else but accumulations of epithelium. I have not seen them ulcerated at birth, but after they had lasted for sometime, and had been either neglected or maltreated, ulcerations had formed, which sometimes reached down to and into the bone. I have seen these small, originally physiological, deposits give rise to difficulties in regard to sucking.

Cohesion of the lips in the median line, as they are sometimes described, I have not seen.

Fissure of the cheeks I have seen several times, and have noticed that generally sucking was impeded by it.

The tongue, however, is at some time or other the cause of an inability to suck, no matter whether there are fissures in it or whether there is a fibrous or lymphangiectatic hypertrophy.

This so-called makroglossia is the more serious, the more liable it is to grow, and as a rule it is connected with other deformities, and in many cases with idiocy.

Congenital sarcoma of the tongue I have described in the *American Journal of Obstetrics*, Aug, 1869. vascular tumors are not infrequent.

The frenulum of the tongue has been accused of exerting a very great influence on sucking. So it has

been operated upon with either the knife or scissors, or has been torn with the finger nail without cause. When there is the slightest mobility of the tongue, forward and backwards, there is certainly no impediment to sucking, because it is always possible for the baby to produce a vacuum in its mouth. Now and then difficulty of articulation will be found in later life, when it is time enough to operate because of that difficulty. Otherwise I have seen no ill effects from shortening or *elongation of the frænulum* of the tongue. Still there are a few cases in which the tongue through elongation of the frænulum, becomes so movable as to enable the baby to double the tongue thereby producing difficulty in respiration. There are even a few cases in which what has been called "*swallowing the tongue*" has taken place. In them the tongue was doubled backwards, sucked into the larynx and gave rise to immediate suffocation. Some such cases have been reported by Petit, Levret, Hennig, and others.

A serious impediment to sucking, and therefore to general nutrition, is *thrush*. As a rule, it occurs a few days or weeks after birth, but it may occur later. It can be serious enough to weaken even a healthy child. Thus thrush may become dangerous, and even fatal, although thrush of the œsophagus and stomach are very rare indeed.

THE TONGUE

The tongue of the newly-born is generally rather whitish. It remains so a number of weeks. It is very liable to participate in the diseases of the mouth. Its epithelium is easily changed and thrown off. Thus it is that the slightest irritation reddens the tongue, and gives rise to more or less superficial, longitudinal or transverse, mostly quite innocent, fissures. This is the case, however, more particularly in atrophic children, or those who have suffered from gastric catarrh for some time.

There are a number of changes belonging to the tongue in the infectious diseases. The tongue of scarlatina and measles is well known, and a similar condition is now and then found without apparent cause. What has been called psoriasis of the tongue is, in fact, no disease. It is an anomaly of the epithelium, which is easily thrown off, and which shows itself in white islands, circles, and semi-circles, surrounded by such portions of the surface as are more or less denuded of epithelium or covered with normal epithelium. This can remain without producing the slightest influence for many months.

The tongue participates in the general condition of the mouth in thrush and all other forms of stomatitis, diphtheria, and the inflammation following trauma, such as combustion, mostly by hot liquids.

Superficial changes of the tongue are also seen in

diseases of the stomach and intestines. As a rule, however, the fur is very light, remains whitish in color, and is seldom seen thick.

Thus it follows that the tongue is very much more liable to be the seat of local affections, and that it participates in the affections of the oral cavity in general, but that it is not so liable to serve as an indicator in gastric and intestinal diseases as it is in the adult.

The frequency of ("muguet" or) thrush of the vagina in pregnant women renders the early appearance of the same affection in the mouth of the baby a natural occurrence. Besides, the *oidium albicans*, which is characteristic of thrush is identical with the *oidium lactis*, which accompanies the acid fermentation of milk. These two kinds of thrush, first by vaginal infection, and second by acid milk, cannot be distinctly diagnosticated from each other.

To prevent it or remove it, lotions of cold water, or an alkaline solution, after every meal, after every vomiting, sometimes every hour, or even oftener, will suffice. It must not be forgotten to wash the nipple also with an alkaline solution after each nursing, for drops of milk remaining upon it give rise to fermentation and local irritation through deposits of bacteria and vibriones in the fissures below the surface, and from these the mouth of the child becomes again affected.

The floor of the mouth must not be left unexamined. *Ranula* is not infrequent; or similar cystic

tumors, sometimes in the median line, sometimes laterally, may exist. No matter on what cause they depend, they are very apt, by pushing the tongue upwards, to render it immovable and sucking impossible.

DENTITION.

The formation of the teeth begins in the first third of embryonic life. According to Goodsir, narrow grooves are formed, in the sixth week of utero-gestation, between what is afterwards to be the lips and the rudimentary maxillary processes, at a time when the former are hardly visible. The first change consists in the formation of wart-like excrescences upon the bases of the grooves, the grooves, as it were, forming receptacles for these excrescences. This is the first indication of the dental sac with a dental papilla in its cavity. In this cavity the dental substance is gradually deposited.

This is the way in which the dental sacs of the twenty milk teeth are formed. They undergo ossification in the fifth month of utero-gestation. Behind them are the sacs for the permanent teeth, but whether or not there is a communication between those of the former and the latter, is not yet known. After they have been separated from each other, however, there is still some connection between them and the "gubernaculum dentis." The separation is complete when the foetus is finally born. About that time the margin of the dental cavity is cartilaginous, and the root of the tooth begins to grow, and by its formation and growth the tooth is pressed forward. During this process the cartilage of the wall and the gums is made to disappear. The lateral wall of the dental sac becomes

the periosteum of the dental root. Sometimes the cartilage disappears before the tooth has reached it. In those cases the tooth can be felt before it can be seen. The two lower incisors will appear, as a rule, between the seventh and ninth month. Then there is an intermission of from three to nine weeks, and the upper incisors will appear between the eighth and tenth month, with an intermission following of from six to twelve weeks. Six more teeth make their appearance between the twelfth and fifteenth month; that is two upper molars, two lateral lower incisors, and two lower molars. This growth is followed by an intermission of from three to six weeks or more. Four bicuspids protrude between the eighteenth and twenty-fourth month, and the four second molars between the twentieth and thirtieth month.

These twenty teeth are all the infant has before the second dentition begins.

The second dentition begins with the protrusion of the third molars, and this takes place in the fifth or sixth year. About that time the arteries of the temporary teeth are obliterated and the nerves disappear. The alveolus becomes large and the teeth fall out without any caries taking place. At that time the temporary canine lies in front of the external incisors and the first molar. Thus it is that very often in later life the teeth have an oblique position. The wall between the alveoli of the temporary and the permanent teeth becomes slowly absorbed and the milk teeth fall

out painlessly, unless the roots of the teeth have not been absorbed in the order of their first appearance.

In the twelfth year there protrude four more molars. Between the sixteenth and the twenty-fourth year four more molars (or the wisdom teeth) appear, the crowns of which ossify as late as the tenth year of life.

There may be great anomalies with regard to the appearance of the teeth. Now and then teeth have been found at birth. They are generally the incisors. Some of them hang loose in the gums; some however, are solidly imbedded in the gums. Such an occurrence is rare. Thus it is that in some parts of Germany and Switzerland a child born with teeth was regarded as a witch. According to the missionary Endemann, Asiatic nations would throw a baby with congenital teeth or other malformation into boiling water.

About some there is a tendency to development of pseudoplasms. *Maxillary cysts* are mostly congenital. They are either follicular, that is, the results of dilated dental sacs, or they are periosteal, originating chiefly in the periosteum of the teeth and not of the maxilla.

These cysts may contain bones and teeth. Latterly they have been explained by proliferation of embryonal cells. Or they have been regarded as duplicatures of the external embryonic layer.

Other congenital malformations are *cystomata*,

myxomata, sarcomata, fibromata, which originate during the embryonic growth of the pulp of the teeth.

Aberrations from the normal time of the appearance of the teeth as given above are not very rare. Sometimes they will come too soon; sometimes very late, for instance in rhachitis. At the same time the fontanels will close later than the normal period of fifteen months, and the development of the bones of extremities is also delayed. The lower jaw is small. Thus it is that after a while, when the permanent teeth are expected, they crowd each other and become irregular. Not infrequently has rhachitis developed during foetal life, and then, sometimes, several dental sacs are merged into each other, and instead of two teeth we have only one. This is a frequent occurrence with regard to the lower incisors, and corresponds with the insufficient development of the lower maxilla in rhachitis.

Teeth will also appear at a later period than normal when the children suffer from chronic disorders, such as anæmia, slow convalescence, etc.

The protrusion of teeth may be premature. When this premature protrusion of the teeth occurs with syphilis or rhachitis, it is the rule that, after the first teeth have appeared, there will be a long interval before those of the next growth make their appearance, say from four to six months. As a general rule, however, premature appearance of the teeth is connected with premature ossification of the bony system

in general, and of the fontanel and sutures of the cranium in particular. When this is the case, the upper incisors, as a rule, appear first, undoubtedly in connection with the fact of the premature ossification of the upper part of the cranium. This is a serious occurrence. When premature ossification is congenital, it makes parturition difficult and renders the child idiotic or epileptic. It will have the same influence when it occurs at the age of three or four months. It will exert a moderate influence of the same kind when it occurs from the eighth to the tenth month. At all events, it is impossible on the part of the brain to develop favorably when its bony capsule does not permit of sufficient expansion of the brain substance.

It is a peculiar fact that even savage nations have made observations which show their fear of such an occurrence. The Makalaka in South Africa are in the habit of observing whether or not the upper teeth come first. In Bohemia it is a popular belief that the child whose upper incisors come first will soon die.

David Livingstone and Fritzsche report that some nations in Central Africa kill the children whose upper incisors protrude before the lower ones.

In considering the morbid processes which have been said to originate in normal dentition, it should not be forgotten that dentition is a physiological process. As a rule, the gums, even when tumefied, have a pale color and show no symptom of inflammation.

As a rule, also, there is no fever which can be made out by the thermometer. There is no stomatitis; certainly no thrush, both of which are pathological conditions. It is true that there is a certain amount of itching, even pruritus of the gums, and there is certainly a condition of irritation. There is very frequently a vaso-motor disturbance in the shape of reddened cheeks. But even where this is found, it must not be attributed exclusively to the reflex irritation of dentition, because there are a great many conditions in which the same symptom is present; for instance, pulmonary congestion, pleurisy, pneumonia, meningæal irritation.

It is also true that, now and then, there are slight muscular twitchings; and now and then, when the child is half asleep, the eyes will roll. There may even be slight twitching of the extremities. There is sleeplessness, but we must not forget that peripheral irritability increases from the fifth to the ninth month considerably, and that the inhibitory centers do not perform all their functions as in the adult. Thus it is even possible that, now and then, a convulsion will occur, but so far as I am concerned, I have not seen convulsions dependent upon difficult dentition in the course of the last ten years.

It is also stated that there are eruptions dependent upon normal dentition. Urticaria, lichen, eczema are attributed to its influence. It is very questionable whether these cutaneous affections have anything to

do with the momentarily flushed cheeks of which I have spoken. We must not forget that about the time the teeth make their appearance congestion of all the parts of the head occurs uniformly. It is the time at which not only the teeth will protrude but the brain and the skull will develop to a greater degree than ever during human life. Thus it is, that, in most cases, eczema, uticaria, etc., must be explained by uniform congestion of the parts, and not by nervous or other influences dependent upon dentition only.

It has also been stated, particularly by Vogel, that there is, now and then, conjunctivitis on the same side on which the teeth are protruding, and it is said to be purulent. Strümpel suggests that this purulent conjunctivitis, which he assumes after Vogel, may be, perhaps, the result of contiguous irritation, the irritation having extended from the antrum of Highmore and the nasal cavities, an explanation which seems to be very much strained.

It is also stated that pulmonary catarrh, bronchitis, and broncho-pneumonia are very frequent during, and in consequence of, dentition. It has been said that the catarrh may be the result of the large amount of salivation running out of the mouth upon the chest in such children. With regard to inflammatory diseases of the chest we must not forget that there are several causes which, about the time of dentition, are met with very frequently. It is the time in which children are more exposed to atmospheric in-

fluences. It must be remembered that within the first year the mortality among infants is greatest from diseases of the organs of digestion; in the second year from diseases of the organs of respiration, undoubtedly in consequence of the fact that during that period infants are more exposed to atmospheric changes than earlier in life. This is one of the reasons why, at the time of dentition, not in consequence of dentition, pulmonary diseases are frequent.

There is another cause, and it is this that rhachitis is certainly on the increase in our country. It has always been more frequent than it has been reputed to be, especially that form which is unattended by any considerable amount of glandular swelling. Even the glandular enlargement need not be visible about the throat, but it is perceptible in the deep-seated cervical glands, and in the lymphatic glands of the mediastinum. These swollen glands give rise to bronchial catarrh, frequently, to acute and chronic bronchopneumonia, and not infrequently to phthisis even at that early age.

Another ailment which is frequently attributed to dentition is diarrhœa. Is it found in most children who are teething? Certainly not. The large majority of children who are either at the breast or whose artificial food is well selected, do not suffer from diarrhœa, while going through the process of dentition.

The occurrence of diarrhœa has been attributed to several causes. Some have attributed it to swallow-

ing a large amount of saliva and oral secretion which begins to show itself in children of three or four months of age, and continues a number of months. Nobody has ever stated that the copious salivation of the fourth or fifth month gives rise to diarrhœa; still, when the infants are six or seven months old, the diarrhœa is said to be the result of the same salivation.

Others have said that the reputed dental diarrhœa is due to nervous influence showing itself in reflex disturbance of the splanchnic nerves. But the explanation has not been given, still the presumption prevails that this diarrhœa must be of a neurotic character.

It has appeared to me that the fear lest dentition should produce diarrhœa has been very much exaggerated. At all events, the popular belief that there is such a thing as dental diarrhœa has given rise to the practice of not caring for such a diarrhœa, and many an incurable enteritis, and consecutive lymphadenitis and atrophy has been due to the very fact that such a diarrhœa has been neglected. In all such cases, no matter whether diarrhœa or bronchitis, or consequent diseases are present, it is wrong to fall back without looking for the diagnosis of something more, upon dentition as the cause of these affections. A large number of diseases which have been attributed to dentition, owe this erroneous diagnosis to the fact that the diagnostic powers of the practitioner were lim-

ited like those of the public with which he had to deal. This much I may add, that the local treatment of swollen gums, which consists of lancing, has fortunately become less common and popular than it was in former times. Although I see a large number of infants in the course of a year, I can state that in not more than two cases have I felt called upon or been induced to lance the gums in the last five years. In a few cases I have done so under the impression that it might do good, inasmuch as the diagnosis of my case was not quite clear. In most cases in which I lanced the gums I found, two or three days later, pneumonia which was quite easily diagnosticated, but which did not develop sufficient symptoms early enough to prevent me from making my mistake.

Is there anything which has not been attributed to the injurious influence of the second dentition? There are many amongst the public this very day (perhaps also amongst the practitioners?) who would be apt to coincide with E. Smith (*Lancet* I, 1869, p. 23), who expresses the conviction that the copious secretion transmitted from the oral mucous membrane is a very serious matter. According to him, the children become pale, thin, restless, appetite irregular, either diminished or exorbitant, bladder incontinent, constipation alternates with diarrhœa, worms are more copiously raised in the intestinal mucus. Thus matters get worse and worse, until the child dies

of phthisis. I should say that "phthisis" might and ought to have been diagnosticated before, and perhaps prevented, if the dentition-ridden medical man had known how to look after chronic glandular swellings, or chronic pleurisy or pneumonia, as the possible cause of the fatal termination.

Of 100 deaths occurring in New York city in the course of one year, 29.63 take place in the first; 10.3 in the second; 4.37 in the third; 2.40 in the fourth; 1.64 in the fifth; 3.20 in the sixth year. Thus in the first six years occur 51.28 per cent. of all the deaths. The whole period from the end of the sixth to the eleventh year gives only 1.50 per cent. of all the deaths.

Thus there is considerable resistance on the part of the child's organism, after it has been fully developed to its seventh and eighth years.

There are some other facts which prove that this time is rather immune than otherwise.

Growth is most rapid in the first few years of life, not only as regards the head, but also the rest of the body. The length of the new-born is 18 inches; that of the adult 66 inches. The increase in the first year is 10 inches; in the second 4 inches; in the third 4 inches; in the fourth 3 inches; in the fifth 3 inches; in the sixth 2 inches; in the seventh, eighth, ninth and tenth, each 1 inch. Thus there is retardation of growth after the completion of the seventh year.

The proportion of the upper part of the trunk,

that is the chest, to the lower, in the newly-born, is as 1 to 2; in the adult as 1 to 1.618. This normal proportion is attained with the eighth year.

The lumbar portion grows principally until the ninth year; then again between the twelfth and fifteenth, about the time of puberty.

Between the seventh and ninth years there is retardation of the growth of the lower extremities, as also the trunk and the whole body.

In the newly born, the proportion of the upper part of the head, the skull, to the lower part is 1 to 1; in the adult 1 to 1.618. This stationary proportion is attained with the eighth year.

After all, then, this is the time of the second dentition. Where, now, are the dangers to life?

Still, though not a serious danger, a great and permanent inconvenience and injury may originate between the first and second dentitions. They may result from the fact that the wall between the cavity of a temporary tooth grows thinner and disappears very gradually by premature evulsion of the temporary teeth, particularly the bicuspid. The permanent teeth are very easily injured inasmuch as they are imbedded between the roots of the temporary ones. The damage done by such action is frequently greater than that resulting from retardation in falling out, on the part of the temporary. But in the latter case, also, the beauty, position, and number of the permanent teeth can be impaired. Thus at this early time

the advice of a professional dentist is frequently required.

There is but one good cause for premature evulsion of the milk teeth—namely—general periostitis or ostitis of the maxilla produced by inflammation of the root of the tooth.

It would be a mistake, however, to believe that we are more mediæval than other nations. The measures for relieving the dangers from the cruel attacks by the ambushing teeth, upon the unsophisticated baby, prove better than anything else how the maternal (and professional?) minds have been impressed by awe-stricken faith down to the second half of the enlightened nineteenth century. According to H. H. Ploss,* in different parts of Germany, Austria and Switzerland they resort to the following measures: A trowser button and the dried umbilical cord is kept under the pillow. The tooth of a colt a twelvemonth old is worn around the neck at the time of the increasing moon. The paw of a mole—bitten off—is sewed in and worn around the neck. The baby to be licked by dogs. The head of a mouse to be used as the above mole head. Every female visitor gives the baby a hard egg. The baby is carried to the butcher, who touches the gums with fresh calf's blood. The gums are touched with the tooth of a wolf, with the claw of a crab. The baby is supplied with three morsels from the first meal in the new residence after the wedding. Bread from the wedding feast of a newly married couple in good repute. A muss of lindsprouts cut at twelve o'clock on Good Friday. A bone found by accident, under the straw mattress. Mother, when first going to church after confinement, kneels on the right knee first. A man coming to visit, is silently given a coin, touches the gums of the baby three times and—goes to the tavern. So he does.

* *Das Kind in Brauch und Sitte der Völker*, 1876, II vol.

STOMACH.

The stomach and intestines participate in the general development of most organs. Between the embryonic state, and the individual after birth, or in advanced age, there is a great histological difference. The former exhibits a rapid cell growth, the latter excels in tissue formation. In the stomach, after birth, the glands increase both in length, number and specific glandular structure, the mucous, submucous, and muscular layers while losing in cell growth, gain in fibre, and density, and the lymph-vessels become narrower in width, and less in number, between the denser tissue. I have said in another part of this volume, that the very young stomach excels in absorption, the advanced child in digestion. The same process is seen in the duodenum (and in the lower parts of the intestine), inasmuch as the villi and duplicatures increase in number and size and thus add to the surface, and the glands, mainly Brunner's, grow perceptibly (A. Baginsky, Virch. Arch. vol. 89).

The foetal and newly born stomach in the living, and the intestine contain mucus and meconium, never air. No food having been given, the stomach contains air after half an hour. The intestinal tract fills then up, gradually within the next twenty-four hours. Air cannot gain entrance except by swallowing; even normal air produces fermentation and putrefaction; the air of a room or bed with puerperal fever may

yield a septic process in the newly born, though no other inlet of the poison, in that case, exists in either umbilical cord, or a sore surface, or mouth.

The capacity of the stomach is very variable, and changes rapidly. From 35 or 43 cubic centimetres it increases to 153 or 160 within a fortnight, and 740 after two years.

The fundus of the stomach of the newly born is only slightly developed. It remains so until about the tenth month. During all this time it resembles greatly the stomach of the carnivores. The empty stomach, in its position in the abdominal cavity is not flattened, as has been assumed. Only in the body of an infant that had not breathed, Braune found the stomach flattened antero-posteriorly. According to Fleischmann, the cardia, in the infant, is situated in front of the tenth dorsal vertebra, a little to its left. A pin run through the left margin of the cardia strikes the sixth left costal cartilage in the mamillary line. When the stomach is expanded the cardia is not pushed sideways. The pylorus is fastened similarly, but not to the same extent. When the stomach is contracted or collapsed, the pylorus is always the lowest point, and is found in the median line between the tip of the ensiform process and the umbilicus. In the majority of cases, the pylorus is the lowest point, even when the stomach is expanded. The pyloric portion of the infant's stomach does not extend beyond the median line of the body, while in

the adult one-sixth part of the stomach extends beyond this point. Besides there is this difference: when the stomach of the adult is filled, cardia and pylorus are in almost a horizontal line, which is not so in the nursling. Nor is the lower part of the stomach ever turned in such a way as to become the anterior aspect. The empty and contracted stomach of the infant is inaccessible to physical examination. The liver is very large. Even in normal condition the left lobe of the liver is sometimes so large as to entirely cover the stomach, and completely or nearly reach the spleen. Thus, whenever the stomach is empty, the tympanitic note heard over it belongs more to the colon and the rest of the intestine than to the stomach itself. Even when the stomach is filled, there is only a small triangular space, between the liver and spleen, accessible to direct percussion. Sometimes the stomach is entirely covered by the colon, and whenever the liver is turned upward and forward, which has been said to be possible by filling the stomach, that change in position is due more to the colon than to the stomach.

GASTRIC DIGESTION.

Very young infants do not masticate. The secretion of saliva is in the very first days comparatively small, and its diastatic effect is not instantaneous. Thus the nature of the articles of food is as it were predestined, and their digestion is left mostly to the stomach. Hence it is that, when nothing but good woman's milk is given, peptones are seldom to be found in the intestinal canal, or their remnants in the stomach. The cardiac and pyloric portions of the stomach contribute but very little to digestion, and in the very young the peptic glands resemble to a great degree muciparous glands. Still, it is certain that the stomach of the newly born has been sufficiently prepared for gastric digestion. Pepsin is present in the third or the beginning of the fourth month of uterogestation; there is a good deal of it at the end of the fourth month. It was found a little later by Koelliker. According to him, the development of the gastric glands takes place in the fourth month only, while gastric acid is met with at a still later period.

At that period of life the gastric muscles are feeble, with the exception of those layers which, beginning from the œsophagus, are distributed along the smaller curvature. The transverse fibres are thin, and the external longitudinal fibres are not perceptible on the pylorus. The pyloric valve is only slightly de-

veloped, and the part next to it is short and cylindrical.

The fundus is but little developed, occupies an almost vertical position, and approximates that which is observed in the embryo or in the carnivorous animals. This cylindrical shape of the stomach of the baby, which, moreover, is imbedded between the large liver, the abdominal wall, and the almost perpendicular diaphragm, is the cause of the facility with which babies vomit. They, as Schiff says of dogs, "do not enter into a long discussion with undigested food." This vertical position changes but gradually, but more readily only after large quantities of vegetable food have been partaken of, in the same way as the fundus of the stomach of dogs and cats is changed in its shape by mixed feeding.

There is no reason to believe that there is any essential difference between the secretions and digestive process in the infantile and the adult stomach.

The questions whether pepsin and gastric juice originate in the same glands, whether gastric juice is secreted in the same glands but in other cells, or whether hydrochloric acid is the result of the secretion from the muciparous glands acting on the chloride of sodium, are physiologically the same in children as in adults.

Caseine is coagulated by pepsin, to be dissolved again after a little time. This process takes place, even when the reaction is alkaline, with this exception

that when it is alkaline the temperature required for coagulation is higher. The presence of acid appears to *aid* the formation of cheese (but it is not absolutely necessary). There is more pepsin about the fundus, also near the pylorus than in other parts of the stomach. Peptic coagulation, however, and coagulation by acids act unequally. The latter takes place in finer flakes; the former consists simply in milky discoloration as long as the caseine is unmixed. But caseine which contains the phosphate of calcium coagulates into a thickish mass that contains a great deal of calcium and phosphoric acid.

This last point is of great importance; for, in the hygiene of infantile age, an exaggerated importance is attributed to the copious or superabundant administration of calcium. That practice is mostly either useless or dangerous.

There is another important point concerning the digestive powers of the infant, and that is the quantity of water in the food. This is especially important as to the secretion of and the effect to be produced by pepsin. The secretion of pepsin depends, to a great extent, on the nature of the ingested food. It is considerably increased by the ingestion of beef soup or solutions of sugar, or solutions of digested meat, and particularly of dextrine. Thus is explained the beneficial effect of soup taken before meals, inasmuch as it is quickly absorbed and increases the facility with which the pepsin required for the coming meal is

secreted. Schiff has observed that the quantity of pepsin will increase even when dextrine injections are thrown into the rectum. Thus far I do not know that this physiological observation has been utilized for therapeutical purposes.

As soon as milk arrives in the stomach, water and most of the salts are absorbed, and pepsin is secreted.

Butter is not digested in the stomach, and expects its further changes under the influence of the bile and pancreatic juice, which, however, are only slightly efficient at the earliest period.

Caseine remains in the stomach where it is under the influence of the digestive fluids which require large quantities of water. It is an old observation that water facilitates the digestion of caseine. When, in experimentation, artificial digestion of caseine ceases, it can be re-established by the addition of water.

Not only is the secretion of pepsin increased, but the formation of hydrochloric acid is improved by water.

Any cause which renders milk more concentrated than normal, disturbs its digestion. Condensed milk requires a very considerable dilution. Increased frequency of sucking, which changes the milk, renders it more indigestible; also hot weather, fever, menstruation and pregnancy of nursing women, produce the same effect, and require the copious use of water.

The formation of acid in the stomach depends

mainly on the introduction of solid substances, while the formation of pepsin depends chiefly on liquids.

When adults do not bear fluids, it is because the proper proportion of acid and water, 4 to 1,000, has not been obtained. In dyspeptic disorders of this kind, the introduction of a small quantity of hydrochloric acid, largely diluted, or, still better, the addition of more chloride of sodium to the food, is indicated.

In children this disproportion does not occur so frequently as in the adult. They have a natural tendency to the formation of acid. Milk sugar changes into lactic acid, which is the *essential requirement for the first stage of digestion*. But water is often wanting. Small children are not, as a rule, supplied with water; besides, in the first months no fluid is secreted in the oral cavity, which, when swallowed, might have a local effect in the stomach. Thus it is easy to understand that infants usually have rather too little water with their food than too much. This is a very important reason why the food of infants should be given in fair dilution; the dilution may be even greater than the usual rules allow.

STOMACH AND INTESTINES.

There is no class of diseases more frequent in the infant than those of the gastro-intestinal tract. They are somewhat rarer in advanced childhood. They originate on very slight provocations. As a rule, they are produced by errors in feeding, either as regards the quality or quantity of food. Most infants and children eat too much and too often. The food of which they partake should be mostly of an albuminoid character, but this is very apt to undergo fermentation and putrefaction. Thus it is that functional disorders are very easily observed. Such disorders of function will now and then run their course without producing many anatomical changes. Thus, dyspepsia, diarrhœa, colic, are occurrences and names not always connected with a great many or extensive anatomical lesions. Still, we cannot imagine a disorder of function without a disordered organ, and it is always necessary to endeavor to find the connection between a clinical diagnosis and corresponding anatomical changes.

Disorders of the stomach and intestines are frequently found together. Diseases of the stomach will extend downward, and diseases of the intestine upward.

Therefore, the pathological and anatomical separation of the two is, in many instances, very difficult indeed. Diseases of the mucous membranes are apt

to extend over large surfaces. Besides, the lymphatic apparatus participates in every process affecting the mucous membrane. A catarrh is very liable to be transformed into an inflammation. The two are very often combined, and an acute process may become chronic, and the chronic processes are apt to undergo acute relapses. All of these are conditions and changes which occur very frequently.

In most of the disorders of the stomach and intestines, which we are called upon to see, there is only tumefaction of the mucous membrane and the glands, even in those cases in which the symptoms are very serious and the consequences dangerous. Thus the diagnosis between chronic and subacute catarrh, subacute and acute catarrh, acute catarrh and inflammation cannot always be made with absolute certainty. Nor is it necessary, as long as it is remembered that these several conditions will merge into each other both clinically and anatomically. There are unmixed and uncomplicated cases, but they are rare indeed.

DYSPEPSIA.

One of the disorders of function, dependent, sometimes, upon slight changes in the gastric mucous membrane, is called dyspepsia. The name means partial or complete loss of appetite with slow or absent digestion. In regard to this, however, in every individual case it is well not to rely too implicitly upon the tales of mothers or nurses. Older children will complain of præcordial heaviness. They will suffer, as also do infants, from eructations, which when they result from swallowing air, are absolutely odorless, and, when they consist of actual gastric gases, have a very faint odor. A sensation of oppression and of pain in the forehead is complained of by other children; the younger ones are apt to vomit.

The causes of dyspepsia must be sought for either in anatomical changes in the organ, which can rarely be proved; or in quantitative or qualitative changes in the secretion, which are more frequent; or in a changed nerve influence, as for instance, in fever; or in an abnormal condition of the food, which is the most frequent cause.

The treatment of this disorder consists chiefly in abstinence or in the use of the most simple diet. On this point I shall have more to say elsewhere.

In infants who have been fed artificially, the gastric secretion is apt to be more than usually acid. In those cases alkalies should be given at once. The

treatment of adults in such cases has, in late years, consisted in washing out the stomach. To what extent, in the future, this practice can be made useful in children and infants, remains to be seen. There are some who speak very favorably on its indications and successes.

POLYPHAGIA—BULIMIA.

In some forms of gastro-intestinal disorders there is no loss of appetite. On the contrary, there are even babies and children who suffer, to an exorbitant degree, from what appears to be appetite or hunger. There is a constant craving for food.

Sometimes it is the result of bad habits. In these cases the infants and children will look for sweet articles of food mainly.

In other cases, however, there is a substantial anatomical reason for the affection. This is to be looked for more especially when the young patient does not increase in weight, or does not hold its own weight, while the symptom still continues.

A frequent cause of this disorder is the presence of an excessive number of intestinal worms. In many we have to deal with hypertrophy of the mesenteric glands, either of "scrofulous" origin or, which is more frequent, due to neglect of chronic diarrhœa. In a few cases the symptom is due to chronic disorders of the brain.

VOMITING.

Vomiting has been mentioned among the symptoms which accompany dyspepsia. In the infant, however, it is almost a normal occurrence. The infantile stomach is vertical and cylindrical, and the fundus is but little developed. Thus whenever there is a tendency to empty the stomach, the anti-peristaltic motions do not press against the fundus, but directly upwards. There is, therefore, less real vomiting than a mere overflow of the contents, which takes place so easily that the babies are not disturbed by it.

The treatment of such cases, if treatment be required at all, would consist in the application of some dietetic rules. The infant should have less food, and at longer intervals; should not be carried about immediately after meals; ought not to be shaken or jolted, nor carried face downward.

This overflow takes place, as a rule, immediately after the baby has been nursed. If so, the milk is still fluid. If vomiting occurs a little later, the milk will be coagulated; if then the milk be not coagulated, the stomach is not in a normal condition. In these cases, and particularly when the baby lives on artificial food, there is uneasiness and pain associated with the vomiting. An acid mucus is expelled together with contents of the stomach; these are the cases in which anti-fermentatives, such as nitrate of silver, bismuth, resorcin, are indicated. Sometimes antacids alone will suffice.

In a number of cases vomiting is preceded by more serious symptoms. Now and then paleness and a condition of collapse are present, which last until the act of vomiting is completed. In order to terminate the disagreeable symptoms it may be necessary to accelerate the vomiting. This should not be done by emetics, unless their need becomes absolute. As a rule, friction of the epigastrium and tickling the throat will be sufficient to produce the desired effect.

When there is vomiting, it is necessary to look for other causes, such as particularly, in the cases of older children, mental emotions, fear, and fright. A very frequent cause of vomiting is the presence of ascarides in the stomach. They leave their habitat in the intestine, crawl upward and enter the stomach. Now and then, even without exciting vomiting, they make their appearance in the mouth, pass through the nose, and, in rare cases, even through the ears.

Vomiting is also a symptom in the incipient stage of acute diseases, as, for example, intermittent fever and pneumonia; particularly also of poisoning, either by poisons introduced into the stomach or such as circulate in the blood; that is, acute eruptions, especially scarlet fever.

Finally, diseases of the brain with irritation of the pneumo-gastric show, among the very first symptoms, vomiting, which is especially liable to take place when the children change their position, or are raised up suddenly.

ACUTE GASTRIC CATARRH.

The feeble, the anæmic, the convalescent, and the feverish are predisposed to this affection. But it may occur in the previously healthy as well. In all such children the production of gastric acid is diminished, and thereby digestion is impaired. Besides, in all of them, muscular power is reduced.

Cold or hot ingesta, too large quantities of food, acids, spices, irritant medicines, alcoholic drinks, fat meat, cake, decomposed food with its ferment, may each be the cause of acute gastric catarrh. That dentition, as such, is not a cause, has been mentioned already. Exposure to the influence of changes of temperature is certainly apt to produce it.

Opportunities to study the pathological anatomy are not frequent, for uncomplicated cases are seldom the subjects of post-mortem examinations.

In all of the cases the epithelium is swollen and changed in its composition. The mucous membrane is injected, pink, thickened, and folded, and its surface is gray with transformed epithelium and mucus.

Symptoms.—Not infrequently there is fever, with a temperature of 104° F., or more. When the temperature is high, the local irritation considerable, and the children young, convulsions are frequent. There may be vomiting. It is acid, and consists of food and mucus, and later contains bile. Vomiting is very copious, flowing through the mouth and nose at the

same time. There is a great deal of thirst; the patient wants water all the time, and swallows it greedily. The tongue is seldom changed much in the beginning. There is pain in the stomach and precordial region. Older children complain of a sensation of fullness. In the later stages the mouth is red and dry, the tongue furred, there is an acid odor, but seldom is the fœtor present that is noticed in adults. There is no appetite. There is some stupor, and sometimes delirium.

Senator is inclined to lay much stress on self-infection by sulphide of hydrogen. Litten found in this disease the peculiar odor of fruit, also acetone, tested for by the chloride of iron, which is characteristic of diabetic coma; thus he compares the nervous symptoms of severe acute gastric catarrh with those of the final termination of diabetes. The urine has a somewhat high color, and is diminished in quantity. Generally there is constipation. Respiration is accelerated in proportion to the temperature only. The inflammatory or catarrhal condition may extend downward to the duodenum, and give rise to jaundice; sometimes so frequently that epidemics of *gastro-intestinal icterus* have been observed (Rehn, Flesch). In this condition the child remains for one or two days, then it begins to improve, the mouth being the last to return to the normal condition. At that time labial herpes may appear.

Diarrhœa will set in now and then. Appetite will

return slowly, but not infrequently increase into hunger, thus great precaution is required with reference to diet.

Occasionally, when no care has been taken a chronic catarrh will result from an acute attack.

The diagnosis of acute gastric catarrh may be easy enough when the history of the case is simple. It may be difficult when there is no history, and the symptoms are very severe.

Convulsions may also occur in primary meningitis, mainly in the purulent or the fibrino-purulent forms, which run an acute course with few or no premonitory symptoms. But in primary meningitis, other symptoms, for instance those belonging to the pupils and to the central nerves in general, will show themselves.

Besides, the convulsions in acute gastritis are apt to cease after a while and not return, except in those cases in which the first convulsion produces permanent central symptoms by an effusion or extravasation.

Convulsions are also possible in pneumonia, which now and then begins with one or more. When the fever remains high for several days, it speaks more for pneumonia than for gastric catarrh, although no physical signs of pneumonia may be found. Indeed, in many cases pneumonia, when it begins centrally, cannot be detected by auscultation and percussion until a number of days have passed. But in pneumonia the proportion between the pulse and respiration is very soon changed, in this way, that the normal ratio of ten respirations to thirty-seven or thirty-eight

heart-beats is disturbed. When there is such a disturbance, and there is a greater number of respirations in proportion, the respiratory organs must be suspected. It is true that the moaning pneumonic respiration may be met with in colic and also in tenesmus, but in pneumonia it is apt to be constant, and colic and tenesmus will also be attended by other diagnostic symptoms.

Typhoid fever may appear, particularly in older children, quite suddenly and with a high temperature. This occurrence is exceptional, but it is occasionally met with. The slowly increasing scale of temperature, of which so much can be read in the books, is not so often seen in practice. When I consider the course of typhoid fever in the young and in the adult as I see the cases in New York, and hear of them in the States, it appears to me that the books have copied from each other, and not from observations of nature. Typhoid fever will not be attended by the labial herpes seen in acute gastric catarrh.

The prognosis is favorable, although in the very beginning, during the convulsions, central hemorrhages are amongst the possibilities, and relapses are frequent.

Treatment.— Remove the injurious substances from the stomach. If vomiting have not occurred or not sufficiently, it should be provoked by tickling the fauces, and friction of the precordial region. These, as a rule, will suffice, but if they do not, quantities of

warm water or mustard water will answer a good purpose. Ipecac in powder or turpeth mineral are good and efficient remedies. Also apomorphia, either internally or, if necessary, by subcutaneous injection. The syrup of ipecac is a doubtful and unreliable preparation. Purgatives should not be given in the beginning; large enemata will act more favorably, as warm water, or warm water with anti-spasmodics such as asafœtida, or local stimulants such as turpentine. After a day or two, calomel, two to six grains, according to age, will answer well.

Fever, unless it be high, requires no special treatment. In urgent cases only ought antipyrin to be given. As a rule, cold applications to the head will act well when there is a tendency to convulsions. Cold applications to the heart will reduce the temperature of the whole body. A warm bath will frequently do good. *I do not advise bathing or handling the child much while the convulsion is on.* When thirst is very great, small quantities of ice-water should be given often, or Seltzer water, or Vichy or Appollinaris. Also water to which dilute muriatic acid has been added in the proportion of one to three or ten thousand.

Solid food must not be given. When there is a great deal of mucus, milk must be given very much diluted, or prepared after Rudisch's method, mentioned elsewhere. When the tendency to vomit is great, food and drink must be given in teaspoonful

doses, and where the sensitiveness of the stomach is very marked, mucilaginous and farinaceous foods only will answer, together with small doses of bismuth repeated every one or two hours.

Where acid is predominant, calcined magnesium will answer best, given in small doses, frequently repeated. Also bicarbonate of sodium, although the latter does not act so well, because of carbonic acid being set free in the stomach.

In cases of constipation the magnesia alone will usually suffice, or tablespoon doses of Carlsbad waters, or Congress water, may be given every one or two hours.

The German preparation, the aqueous tincture of rhubarb in doses, to children, of 10 to 30 minims every two or four hours, answers very well.

CORROSIVE GASTRITIS.

The deglutition of strong acids or alkalies is apt to result fatally in a very short time. When a fatal result does not occur, there is, besides the local affection, an inflammatory reaction around its margin; afterwards, ulceration and cicatrization. When the effect is local, it is generally found in the large curvature opposite the cardia. In mild cases there is hemorrhagic erosion, punctiform or longitudinal. The surface is denuded of its epithelium or there may be deeper loss of substance. The lesion can be easily distinguished from tubercular ulceration.

In mild cases the symptoms are those of acute or chronic gastric catarrh. In severe cases there is persistent vomiting of mucus of a bloody character. There is pain, and fever.

The local effect produced by nitrate of silver differs from the above. When nitrate of silver in substance touches the mucous membrane, its effect is quite local. It will stick to the place it first touches. It forms an albuminate on the surrounding mucous membrane, and is very apt to be buried in its own albuminate, thereby becoming partly innocuous for some time. Thus I found it to be in the case of a little child that had swallowed a stick of nitrate of silver which was applied for the purpose of cauterizing the throat in a case of presumed diphtheria. It

was, moreover, a case in which no chloride of sodium had been given as an antidote.

In the cases of poisoning by lye or acids, these should be neutralized, in the first instance by diluted acid (lemon juice, vinegar,) and in the second by dilute alkaline solutions (lime, magnesia, soap).

When plenty of neutralizing fluids have been taken, the stomach pump may be used, and the organ washed out. But the greatest precaution must be taken in introducing the tube. I once saw an œsophagus that had been perforated by a bougie in the hands of a careful man; and the child died. In the right pleural cavity there were twelve ounces of milk and whiskey.

The only thing to be done for some time in this class of cases is to administer ice, milk, and opium. Later, nitrate of silver greatly diluted, bismuth, and weak solutions of chloral hydrate. Baginsky recommends iodoform.

DIPHThERITIC GASTRITIS.

This occurs rarely, and then only as a part of general diphtheria. The deposits on the mucous membrane of the stomach are small, detached, and macerate very easily.

In these cases there is bloody vomiting and pain, together with the other symptoms of diphtheria. Large masses of diphtheritic exudation are found less in diphtheria proper than in variola, or typhoid fever of severe character.

A five year old child seen by me twenty-five years ago in Thomas street, New York, had the œsophagus completely filled, and the stomach lined with a thick croupous membrane like those filling the bronchial tubes in cases of fibrinous bronchitis. In that case there was no bloody vomiting. The child died more of the general symptoms of typhoid fever than of the local affection.

SUPPURATIVE GASTRITIS.

This consists in the formation of small or large abscesses in the wall of the stomach. The location of these abscesses is in the submucous tissue, but they may extend through the muscular layer to the serous membrane. Thus it may give rise to perforation. Fortunately it is very rare indeed. The only case I have ever seen in a child, was the result of pyæmia.

CHRONIC GASTRIC CATARRH.

Hereditary predisposition to this affection has been observed in whole families. It may be the result of acute gastric catarrh, without reference to the cause of that disease. It follows the persistent ingestion of injurious food, and erroneous diet in general. It is very frequently complicated, in older children, with intellectual overexertion, and insufficient attention to the skin. It results, not infrequently, from general disturbances of the circulation, those particularly which depend upon chronic adhesive pleurisy and pneumonia, chronic cardiac disorders, and disturbances of the portal vein brought about by too much schooling and during slow convalescence attended by constipation. It is the result, also, of local irritation produced by alcoholic drinks, and the influence of bad air, particularly when heated. Impaired innervation is a frequent cause. Masturbation in younger and older children is a frequent source. Also the impairment of the general health by rhachitis, which is so apt to influence muscular action, and tuberculosis, caries, and "scrofula."

The disturbances of circulation alluded to diminish the secretion of gastric juice, particularly of the muriatic acid, which is needed more than the pepsin. Thus the products of fermentation are formed, such as lactic, butyric, and acetic acid, which will increase the chances of the development of catarrh.

If there be a large quantity of mucus, it covers the ingesta, thus preventing the gastric juice from exerting its normal influence on the food; besides, mucus having an alkaline reaction, it diminishes the effect of the gastric secretion.

The peristalsis of the stomach is impaired by the catarrh, inasmuch as the muscular layer becomes œdematous. In that condition the stomach is more apt to be expanded and undergo dilatation by large quantities being introduced into the stomach.

Disturbances of circulation, by preventing normal absorption will, moreover, prevent the absorption of peptones present in the stomach. Peptones formed out of food must be absorbed immediately, as otherwise they are known to disturb the peptonization of the albuminates. In all those cases in which peristalsis is deficient these peptones, after they have been dissolved, are apt to remain behind.

The anatomical changes in chronic gastric catarrh are not always considerable. There is a large quantity of viscid and grayish mucus, mixed with much epithelium, upon the mucous membrane. The mucous membrane is mostly red, or red in patches, sometimes gray, by deposit of pigment, and in small spots there are ecchymoses, over which the epithelium is very apt to be absent. Most of the changes are found in the pyloric portion. After a while the surface becomes smooth, and is apt to get atrophied. Also in protracted cases the glands, which were first swollen,

undergo atrophy, while the cellular tissue between them may be thickened, the whole mucous membrane hyperplastic and folded. The submucous tissue may also be thickened and show a large increase in the number of cells.

The same condition may be present in the muscular layers. In most cases of chronic gastric catarrh the stomach is somewhat dilated.

Symptoms.—The function of the stomach is diminished, and there is a constant tendency to acute exacerbations. The children suffer from loss of appetite, alternating sometimes with craving and hunger which, however, is very easily satisfied. There is great thirst, and a longing for pungent, highly-seasoned food. Occasionally there is vomiting, sometimes immediately after meals, sometimes later. There is considerable nausea, acid taste and eructations, depending upon the prevalence of organic acids, and not hydrochloric acid. There is seldom any blood in what is vomited, but plenty of fermentation products and sarcinæ.

The stomach is inflated and tense, and there is not exactly pain, but a sensation of fullness and discomfort. The tongue is grayish with reddened edges. Now and then there are superficial erosions in the mouth, and there is considerable salivation. Constipation is not infrequent. The skin is pale and flabby. Emaciation takes place frequently. Sometimes diarrhœa alternates with constipation. Sometimes there

is jaundice. The urine contains a large amount of phosphates and is slightly acid. When that condition is of long standing nutrition is so much impaired, that chronic cutaneous eruptions are either apt to result or, if they existed before, will not get well.

Acute exacerbations are not infrequent. Improvement will take place but gradually, and there is a tendency to relapses, the more so as the albuminates of infants are very apt to get decomposed.

The *diagnosis* of this affection is easy enough when it sets in after an acute attack of gastric catarrh, or when the cause is well known. It may become very difficult when such is not the case. Tubercular meningitis is sometimes mistaken for gastric catarrh, inasmuch as vomiting is very often the very first symptom of that disease to which attention is directed. But at the time when the vomiting is observed in tubercular meningitis, there are other symptoms in almost every case. At that time the pulse is irregular and slow. Not infrequently there is severe headache, either constant or paroxysmal. And for weeks previous to the vomiting there are psychical changes, such as peevishness, fretfulness, unwonted quiet, etc. It is true that mistakes are possible on the part of the physician, who does not observe the child more than a few minutes. But as that is so, he should always be aware that a mistake of that kind can be avoided by close questioning.

The result of chronic gastric catarrh has now and

then been mistaken for the ill-nutrition and emaciation attending chronic processes in the peritoneum and lungs. In any doubtful case physical examination should not be omitted.

Typhoid fever may be mistaken for chronic gastric catarrh, and *vice versa*. Both of these diseases may run their full course with very little fever.

Chronic nephritis may be suspected in some cases, but an examination of the urine will clear up the diagnosis.

The diagnosis from other affections, such as ulcers and dilatation of the stomach and nervous dyspepsia, has been discussed in other chapters. The diagnosis of chronic gastric catarrh must never be made, except when other diseases can be safely excluded.

Prognosis is fair, provided great attention is paid for years to hygiene and diet, and acute exacerbations are treated carefully and not without appropriate medicines.

Treatment.—Errors in diet must be avoided, and the quality and quantity of food controlled. Most children eat too much. But little solid food is to be given; no sweets, no fats. The morsels must be small and mastication slow. An acute catarrh must be healed. Masturbation must be prevented. Sedentary life must be forbidden. School hours must be limited, and interrupted by gentle exercise. The school hours must be regulated by the meals, and not *vice versa*.

When there is a chronic disorder of the heart or lungs or liver, it must be attended to. Many a gastric catarrh in the child, also in the adult, will be improved by digitalis. When there is constipation, enemata will act well. Rhubarb and magnesia, rhubarb and bicarbonate of sodium, or the aqueous tincture of rhubarb, in small doses, frequently repeated, will answer quite well. When there is a great deal of mucus, dilute muriatic acid, mixed with plenty of water, and small doses of pepsin will serve a good purpose. When the tongue is thickly coated and there are eructations, the chloride of ammonium with the aqueous tincture of rhubarb will prove beneficial. The tendency to vomit and pain requires bismuth; in older children bitter waters, Carlsbad, or Congress.

The practice of washing out the stomach may come in very well in older children. In younger children it has been resorted to by Demme, when there was a great deal of fermentation, and digestion was very slow.

The meals ought to be scanty but more frequent. Toasted bread and stale bread, answer very well. Milk must be diluted, either on the plan of Rudisch or by farinaceous decoctions. Alcohol must not be given; not too many carbohydrates, and no fat. The milk may be peptonized. Food must be given neither too hot nor too cold. When digestion is slow the addition of chloride of sodium, or sodium bicarbonate, and effervescent drinks in general will often be ef-

ficient, because they stimulate the secretion of gastric juice where there is a good deal of fermentation; creasote in doses of $\frac{1}{4}$ of a minim to 1 minim, three or four times a day, in plenty of water, will serve a good purpose; also a few grains of salicylic acid through the day, largely diluted with water. Benzine has been given, also, in doses of a few drops in water or milk.

A chronic gastric catarrh ought to be treated for a long time with bismuth, nitrate of silver, or sulphate of zinc.

Where there is much vomiting the occasional administration of small pieces of ice will answer well. Also in obstinate cases, very small doses of opium, or chloral, Fowler's solution ($\frac{1}{4}$ m. to $\frac{1}{2}$ m., three to eight times a day), has acted very well when everything else appeared to fail.

Constipation must not be treated with medicines, for sometimes there is *apparent constipation* depending upon the diminished quantity of food given or entering the intestinal tract.

Anæmia must not always be treated by the use of iron. It is badly tolerated in most gastric disorders. Bitter tonics, such as nux vomica or condurango, are not only well tolerated, but prove beneficial. Mountain or sea air will improve digestion and sanguinification.

The washing out as one of the mechanical means has been alluded to. Massage, though ever so gentle, must not be resorted to while the stomach is full.

DILATATION OF THE STOMACH.

This is not rare, although it does not occur so frequently in infants and children as in adults. In the latter it is often the result of obstruction of the pylorus due to carcinoma, or cicatrices, or, which, however, is rare, to pressure from the outside. In one case, for example, reported by Bartels, it depended upon narrowing of the pylorus caused by the pressure of the floating right kidney. In such cases the first result is hypertrophy of the muscular layer of the stomach, which is followed by extensive dilatation.

The causes of dilatation of the stomach in infants and children are:

First. Feeding with amylacea and super-abundance of food in general. This results in over-exertion and expansion in the same way as it occurs in adults with voracious appetite; for instance, those suffering from diabetes.

Second. The voracity of rhachitic children, with their feeble muscular tissue, imperfect digestion, and consecutive gaseous inflation.

Third. Catarrhal inflammation resulting in oedematous softening, particularly in chronic conditions of the same kind and an increased expansion with diminished absorption.

Fourth. General muscular debility, as in anæmia and convalescence.

Fifth. Congenital imperfection, sometimes even partial absence, of muscular development.

Sixth. Peritoneal adhesions of the walls of the stomach, resulting, not only in dilatation, but in deformities of different kinds. Such stomachs are more or less triangular, or quadrangular.

Symptoms.—These include all the symptoms of catarrh of the stomach, and the epigastrium is distended. Percussion does not yield very conclusive results, for the normal stomach of the infant and child is hardly accessible to it. Thus when the stomach is dilated the patient ought to be examined both while lying and standing, and while the stomach is both empty and full.

The percussion sounds are apt to be rendered indistinct by the pulmonary sounds above, and the intestinal tympanites below. Sometimes in the half-filled stomach there are splashing noises on slight percussion. The large curvature is often visible, particularly on gentle friction. Very often there is craving hunger, and at the same time emaciation takes place. There are eructations sometimes of acid, air, and liquid. Also vomiting, not infrequently of large masses, resulting from the meals of the day or two days previous. A brownish-yellow diarrhoea alternates with constipation, the latter being due, now and then, to an insufficient amount of food entering the intestinal canal.

For diagnostic purposes bicarbonate of sodium and tartaric acid have been introduced into the stom-

ach separately, but closely together, to distend it so that it could be measured, as I did in a case of gastrostomy, performed for cancerous stricture of the œsophagus, thirteen years ago. In dilatation of the stomach this method yields only uncertain diagnostic results, inasmuch as the stomach will be dilated by the gas beyond its ordinary size. Whether the stomach sound will be of any service remains to be seen. In the adult it gives good results; for the average distance to which the sound can be introduced into the normal stomach is sixty centimeters from the teeth, while in the dilated stomach the distance may reach seventy centimeters.

But little liquid gets into the blood. Thus the urine is not copious, and the dryness of the tissues in general results in spasm, particularly of the flexors of the arms, the calves, and the abdomen.

According to Ewald, in the *Vienna Med. Presse*, No. 28, 1887, there is a symptom which may be promising, and based upon the changes which take place in salol. Salol is decomposed in the small intestine only. As long as the stomach is normal salicylic acid appears in the urine, as the result of the decomposition of the salol, in from one-half to three-fourths of an hour after this drug has been taken; while in dilatation of the stomach from two to three hours are required. The gross appearance of the urine when salicylic acid is present is about the same which it presents when it contains carbolic acid.

The *prognosis* is better in children than in adults. It is best when it depends upon those conditions which can be improved or cured. It is fair in cases of muscular weakness dependent upon rhachitis, and in catarrh caused by improper feeding.

Therapeutics.—The treatment is prominently that of chronic catarrh of the stomach. Antifermentatives must be given, such as bismuth, nitrate of silver, calomel, and resorcin. The quantity of food taken at once should be small; the meals should be numerous. Nothing should be given that is apt to ferment, like starch. Large quantities of fluid should not be given. Milk in small quantities must be given often. Diarrhœa may require tannin and other astringents; as it depends upon the condition of the stomach, most cases of consecutive diarrhœa will be best treated by attending to the stomach. Raw beef is amongst those articles of food which are most easily digested. Raw milk is not so easily digested as boiled. Peptonized milk is preferable in many cases. Rudisch's preparation will do well because of the ease with which it is digested. A bandage should be worn about the abdomen. The faradic and galvanic currents can be used with advantage. According to Ewald, electricity and massage accelerate the passage of chyme into the intestine. It seems to me that it is questionable whether digestion was improved by them, for it may be that both of these applications resulted in premature opening of the pylorus, before the gastric diges-

tion was finished. *Nux vomica* internally will improve the tonicity of the gastric muscle.

Kussmaul has introduced into practice the mechanical treatment of the stomach by washing it out. In this he has been followed by Leube. According to them, the stomach is to be washed out with either water or with a solution of bicarbonate of sodium in water, one or two per cent., or a one-per-cent. solution of salicylic acid, or a two-per-cent. solution of resorcin. These injections are to be made half an hour before the principal meal.

NERVOUS DYSPEPSIA.

The digestive organs are easily influenced by the nervous system. Emotions will give rise to nausea, vomiting, pain, diarrhœa, particularly in so-called nervous people, or when hysteria or neurasthænia are fully developed. When such influences act frequently, and are combined with hypochondriacal impressions, we speak of nervous dyspepsia. It is met with in men, women, and—less frequently—in children; but in the latter not so infrequently as is supposed.

The symptoms vary. There is either loss of appetite or craving for food. The stomach is very sensitive to food sometimes, but other times it is not sensitive at all, and even errors in diet do not result badly. Pressure on the stomach is sometimes painful, and sometimes it gives relief. Vomiting will often occur without any connection with feeding. It is sometimes acid, and sometimes the eructations have neither taste nor odor. There is a good deal of peristaltic rumbling, which is audible, and the abdomen is generally distended. The movements of the bowels are irregular. There is usually a number of other symptoms, such as irritability, hypochondriacal sensations, vertigo, headache, and paræsthetic disorders such as coldness and numbness, and prickling sensations.

General nutrition is sometimes good. In most cases, however, the patients are pale and anæmic.

Objective examination of the parts is, as a rule, negative.

Hysteria, neurasthænia, and nervous disorders, complicated mostly with anæmia, are by no means so rare in children as has been supposed. All the symptoms reported of the adult woman may be present in the young, both male and female. Such conditions of nervous dyspepsia in the young, particularly in girls between six and twelve years of age, I have seen not infrequently, and they will be observed by anyone who will watch for them.

The causes in general are premature mental exertion, hereditary predisposition, hysteria, congenital or acquired anæmia. In older patients, sexual diseases, and particularly disorders of menstruation.

Therapeutics must be simple, yet the effect is not very encouraging. Food must be digestible and copious. Purgatives should never be given; enemata must take their place, if required. Bitter tonics, mild preparations of iron, country and sea air, cold bathing or sponge baths, electricity, one large electrode being applied to the stomach and another to the spinal column, are indicated.

HEMORRHAGE FROM THE STOMACH.

Blood is expelled by vomiting. It is coagulated and more or less black.

The general symptoms depend upon the quantity of blood lost. There is momentary paleness, and more or less consecutive anæmia. Now and then black blood, viscid and tarry, will be evacuated from the bowels.

The cause is very often a local ulceration; sometimes, however, only venous hyperæmia of the wall of the stomach. Thus pulmonary and cardiac diseases predispose to hemorrhagic extravasations into the stomach, as does also thrombosis of the portal vein and cirrhosis of the liver, which occurs occasionally even in childhood.*

Besides, gastric hemorrhages are observed in acute atrophy of the liver, which, although rare, may occur, in connection with the general hemorrhagic diathesis, in scurvy, morbus maculosus, and leucocythæmia.

In addition to the treatment, which will be given in the following chapter, applications of ice to the stomach will always do good. Opium also is beneficial. I have not seen that any preparation of iron

* R. Palmer Howard, M. D., "On Hepatic Cirrhosis in Children," in Transactions of the Association of American Physicians Second Session, Philadelphia, 1887.

has been of service. On the contrary, it has appeared to me that the coagula, which are formed in the stomach by such preparations as the subsulphate, or the perchloride, act as irritants and produce new vomiting.

ULCER OF THE STOMACH AND DUODENUM.

The round perforating ulcer of the stomach is found more frequently in the newly born and quite young than in advanced childhood, though I have met with it in children from seven to twelve years of age, several times. It is rare, however, in children under ten years old, but about that age it occurs in girls who show distinct signs of chlorosis.

Brinton saw but two cases in patients under ten years of age, in 226 cases. Biedert saw a girl of twelve years who died after two days of exhaustion following gastric hemorrhage. A number of cases have been observed in tuberculosis, after measles and scarlatina. Two of my cases occurred after measles.

The causes of gastric and duodenal ulcers are very numerous. Some enumerate among these arterial anæmia, others venous hyperæmia or stasis in the hepatic vessels; or circumscribed hemorrhages into the tissue. Others assign thrombosis as the cause; others emboli, or lessened alkalinity of the blood, or hæmoglobinuria. In the last mentioned affection, as also in the later stages of diabetes, the blood is slightly acid. In this way hemorrhages and ulcers go hand in hand frequently, and are often the cause of each other, both in the adult and in the young.

In the newly born, hemorrhages from the digestive tract are known by the name of *melæna*.

They result in the vomiting of black blood, also

rectal evacuations of the same nature and color and tar-like consistency and appearance. In the majority of cases melaena occurs from localized and circumscribed ulcers, or from rupture of blood-vessels between the first and third day of life, rarely after the first week.

It is caused by the sudden changes in the circulation occurring at and after birth. At that time, and from the same causes, is hyperæmia of the mucous membrane found extensively, even in healthy babies. Those, for instance, who die from other causes, may exhibit dozens and hundreds of small hemorrhages of the pericardium, pleura, and also in the mucous membrane of the stomach and duodenum.

Hyperæmia results in hemorrhage very much more frequently in the newly born and infants, because of the thinness and permeability of the walls of the blood-vessels. Thus the frequency of meningeal hemorrhages in the very young finds its ready explanation.

Hyperæmia and hemorrhage with their dangerous consequences are met with in vigorous as in feeble infants. Those, however, who are born asphyxiated, are more apt to suffer from them and their possible results.

The principal consequence is ulceration of the mucous membrane into which copious extravasation has taken place. Regular hemorrhagic infarctions are found both in the stomach and duodenum of the

newly born, produced by emboli derived from the thrombi of the umbilical vein and duct of Botallus. They cause both hemorrhages and ulcers.

Another cause of these hemorrhages, which are complicated with, or are the causes of ulcers, is acute fatty degeneration in the fœtus. This process is found mostly in the epithelium and the endothelium of all the organs, and also in their tissues. It renders the blood-vessels and surrounding tissues more fragile and is a frequent cause of gastric and duodenal and general bleeding.

Many of the cases of so-called hæmophilia in the newly-born, particularly those occurring in families where there is no history of hæmophilia, are, indeed, cases of fatty degeneration. It is the same process that has been observed as a frequent occurrence in pigs, and is seen at every age as the result of poisoning by phosphorus, arsenic, antimony, acids, or intense heat.

When ulcer of the stomach or duodenum has been produced by any of the above mentioned causes, either in the young or in the adult, or when it is forming either as the result of old chronic catarrh, or by sudden interruption of the circulation in a circumscribed part of the mucous membrane, thus diminishing or destroying altogether the normal alkalinity of the tissues, the dangerous features are various.

First, the constant presence of acid in the stomach and upper part of the duodenum. This acid will

digest the parts which have been denuded and eaten into, and are no longer in connection with the normal alkaline circulation, and no longer protected against the surface acids. These parts are in a condition similar to the dead gastric tissue in which gastro-malacia is formed at autopsies.

Thus the first indication is to *keep the stomach and duodenum as alkaline as possible*, at all events between meals. The introduction of any food will give rise to the secretion of gastric juice, which is acid, first by lactic, afterwards by hydrochloric acid, but which will be secreted in undue quantity, and normally spent on the digestion of food. Whatever there is, however, in the stomach of unnecessary acid or acids, which are not required for the physiological process, particularly the acetic, the butyric, caprylic, or even an excess of lactic acid, must be neutralized. An occasional dose of an antacid is not sufficient for that purpose, but it must be given regularly. I generally give the doses at intervals of two hours. I also give a dose a few minutes before each meal to neutralize every abnormal acid, no matter whether the patient is an adult or a child. Which antacid is to be selected, the potassium, sodium, calcium, or magnesium salts? Of the latter, I prefer calcined magnesium to the carbonate, as I do not wish the expulsion of free carbonic acid into the stomach. I use it frequently, but rarely (for a child) in larger doses than eight to ten or twelve grains daily. A small part of this, say one grain, is

taken every hour or two, before meals, mostly in water, which should not be too cold; hot water is even better. More than that quantity is seldom tolerated, because of diarrhœa setting in; still its purgative effect is very welcome in patients suffering from constipation; these may take larger doses. When the above quantity does not suffice to neutralize the acids, or it is feared that more magnesium will cause diarrhœa, it may be combined with the carbonate or the phosphate of lime. Sodium bicarbonate does not take the place of the calcium and magnesium so readily, inasmuch as it also appears to promote the secretion of gastric juice. Thus, in most cases, I use magnesium or calcium with or without bismuth, or such adjuvants, if any, as may appear to be indicated for other reasons.

This medicinal treatment must be continued for weeks or months; without it I do not see gastric or duodenal ulcers getting well.

The Carlsbad waters, and salines in general, owe their effect partly to the neutralizing and partly to the purgative influence they exert.

The use of lime water is in part an illusion, if given for the purpose of neutralizing the acid. It is a failure because it contains only a single grain to nearly two fluid ounces of liquid. But when added to cow's milk it certainly makes it more digestible.

The second danger is the persistence of the function of the diseased organ. Both the stomach and the duodenum should be kept as idle as possible, and

their labor should be made easy. Undigestible food must not be given, and solid food must not be allowed. Most cases, in older children, bear boiled milk, strained oatmeal, barley gruel, stale wheat bread, and a few also raw beef. Some take nothing but boiled milk, or buttermilk, or Kumyss. Many, particularly convalescents or adults, will tell you that they do not digest milk. That may be true, but then they gulped it down and it formed a large caseous cake in the stomach that was not afterwards dissolved and digested. They must *boil their milk* in the morning and *heat it several times* during the day almost to the boiling point. They must add a small quantity of *table salt* to it, also, in case the stomach is very acid, some bicarbonate of sodium, or calcium, or magnesium. They must not drink their milk, but pour it upon a plate and sip it with a spoon. Thus prepared, they will digest it, particularly when it is not quite cold. In fact many require their meals warm or hot.

For the purpose of easier digestion, milk may be peptonized, according to Fairchild's directions; or it may be rendered more digestible by the process recommended by Dr. Rudisch. This consists in mixing one part of dilute muriatic acid with 250 parts of water and 500 parts of raw milk, and then boiling it. In this mixture the muriatic acid is kept in the form of chlorides. It does not do so well in ulcers, however, as it does in acute or chronic gastric catarrh.

Mixing milk, prepared as above, with some farin-

aceous decoction, such as I have always recommended and which have been discussed in this book, will also aid its digestibility and add to its nutrient qualities.

On such food, which must be adhered to strictly, the patients will do well and recover entirely.

Many of my patients have lived on milk and butter-milk for months and got well.

In the latter periods of the disease peptonized meats may be used. I use either Leube-Rosenthal's beef solution or J. Rudisch's sarco-peptone. Beware of tin boxes. Of artificial foods I have spoken in another part of this book.

Third. With an alkaline condition of the surface and an innocuous diet, the ulcers have an opportunity to heal. Their recovery may be aided by the administration of nitrate of silver. A child may take from $\frac{1}{30}$ th to $\frac{1}{20}$ th of a grain in a tablespoonful of distilled water four or five times a day, if possible, on a fairly empty stomach. Or, a smaller quantity may be given in a pill with or without a small dose of opium, say $\frac{1}{60}$ th to $\frac{1}{15}$ th of a grain in each pill. Sometimes I give but a single dose at bed time, in addition to the alkaline treatment.

The tincture of iodine, in doses of from one to three drops for the adult, of $\frac{1}{2}$ to one drop to a child, well diluted with water, has often been recommended. Its action is probably antifermentative.

Fourth. When there is much pain and a great deal of acid or other secretion, opiates are indicated

as above, mainly those which are very soluble. Chloral is tolerated badly.

Gerhardt prescribes, particularly in cases where pain is a prominent symptom, from three to four drops of the liquor ferri perchloridi in water. I cannot say that I have been satisfied with the results obtained by this use of the drug.

Fifth. Bad cases require rest in bed, particularly those in anæmic girls and women.

Sixth. The stomach will have a better opportunity to get well when at rest, than when at work. Thus it becomes necessary, sometimes, to abstain from feeding by the mouth altogether. Rectal alimentation then comes in to great advantage. In conditions of such genuine starvation, the lymphatics are very greedy and absorption from the rectum is very active. But the rectum absorbs only and does not digest. Thus whatever has to be absorbed must have been digested previously.

Milk unchanged will not be absorbed, except the water and salts it contains. Thus milk must be peptonized, so also must meat. The preparations alluded to above will prove satisfactory.

Ulcer of the stomach, in both the young and old, being frequently associated with intense anæmia, the result, in these as in many other cases, is mistaken for the cause. Then iron, the great presumed panacea for anæmia, is introduced into the stomach *which can-*

not digest it, and in its attempts to do so, pain, ulceration, and danger are increased.

Particularly is this the case with the chloride of iron which is, more than any other, a vascular irritant. The lactate and malate are better preparations; also the subcarbonate of iron with sugar, of the Pharmacopœia.

But if every thing be correct which has been said in its favor, by Gerhardt, Eulenburg, Uffelman, and others, all these preparations appear to be excelled by the liquor ferri albuminati.

GASTROMALACIA. SOFTENING OF THE STOMACH.

It has always been a question, whether softening of the stomach should be regarded as a vital or a cadaveric process. At all events there are no symptoms which belong to it as such. It consists in a pultaceous breaking down of the tissues, mostly in the fundus of the stomach, and is chiefly found after either exhausting diseases or those connected with excessive fermentation going on in the stomach before and after death. It is true that it is now and then observed where it appears to have existed during life. Thus, for instance, in tubercular meningitis, it has sometimes been found. It has been claimed that, in these cases, it may depend upon, or be connected with, the high temperature of the patient during the last few days of the disease. But the high temperature of pneumonia, or scarlet fever or intermittent fever, does not produce it. It is probable that, in these cases of tubercular meningitis, it was the result of the insufficient circulation and defective nutrition during the exhausting disease, and the trophic changes taking place under the influence of nervous exhaustion.

Thorspecken reports a case of a baby three months old, suffering from sleepiness, cough, dyspnœa and diarrhœa. All at once there was nausea, and an audible snap, followed by vomiting of bloody liquid and death within two minutes. In the fundus of the

stomach there was an opening two centimetres in diameter, surrounded by softened tissues, and accompanied by tubercles in the lungs and the spleen.

This case would be more conclusive if it were more intelligible. We do not know whether the perforation was due to the softening that takes place during the dying process, as in the above cases of tubercular meningitis, or whether it was due, perhaps, to tubercular ulceration. At all events, it appears improbable that the perforation of softened tissue would be attended with an audible snap.

Why is it that gastromalacia is found so much more frequently in the bodies of little babies than in advanced age? It is probable that it is due to the fact that more acid is secreted and the secretion of acid is continued for a longer period wellnigh to the end.

Elsässer wrote a monograph on this subject in 1846; it is still the best and most conclusive. He arrives at the conclusion that gastromalacia is a cadaveric occurrence, for the following reasons:

First.—It occurs mostly in the lowest parts of the stomach.

Second.—A healthy stomach removed from the body softens under the influence of acid fermentation.

Third.—The acid and fermenting contents of the softened stomach, introduced into the stomachs of healthy animals, softened their stomachs, as was proved by autopsy when they were speedily killed.

Fourth.—There is no vital reaction around the softened spots.

TUMORS OF THE STOMACH.

Tumors of the stomach are very rare in infancy and childhood. Several varieties, however, have been observed, such as lipoma, fibroma, myoma, myo-sarcoma, sarcoma, adenoma, dermoid cysts, and multicellular lymphangioma.

Albers met with a cyst two and a half inches long on the small curvature of the stomach of a child.

Congenital carcinomata are very rare, but have been observed. Scheffer has described a case of encephaloid cancer which spread from the stomach to the spleen of a child twelve years old. In that case there was, besides the presence of a tumor, pain, vomiting, emaciation, and collapse.

No doubt, heredity exerts its influence, but it certainly does not exist in every case. For, Hauser appears to have proved positively that cancer may result from epithelial proliferation originating in the cicatrices of ulcers. Carcinoma begins in the mucous membrane; the form called cylindroma in the glands.

As a common symptom hydro-chloric acid is absent from the secretions of the stomach.

Tubercles.—Tubercular ulcerations are met with in connection with general miliary tuberculosis at an early age. Caron reports the case of a girl twelve years old, who suffered from pain and bloody vomiting. Otherwise in these cases there are scarcely any symptoms, except the general ones belonging to the disordered stomach and the tuberculosis.

INTESTINAL DIGESTION.

The stomach expels all cellulose, all starch that has not been changed into sugar; all parapeptones; all dyspeptones resulting from proteinates; finally fat and some salts. Part of them soon become absorbed, a portion is digested, and another part will be expelled, either changed or unchanged.

The large intestine does not aid in digestion. It will absorb water and soluble substances; whatever is absorbed in this way, even in a liquid form, either albumin or sugar, is soon eliminated by the kidneys. Thus, whenever injections are made into the rectum for the purpose of sustaining nutrition, sugar and starch ought to have been transformed into glucose; milk ought to be peptonized; and fat emulsified.

The infantile intestine and its function differ from what we observe in the adult. Lieberkühn's glands exist, but their number and development are less than in the adult. The villi are generally numerous and large. Some assert that they surpass in size those found in the adult intestine. The capillaries of the villi, it is claimed, have a large absolute size, to such an extent that their diameter is larger than that of the same vessels in the adult.

Peyer's patches are not numerous, and they are only slightly developed. Their small anatomical development corresponds with their physiological and pathological significance. For, the infectious fever in

which the morbid process shows itself mainly in these patches, *i. e.* typhoid fever, is, as a rule, a very mild disease in early infancy. In the new-born it is almost unheard of. There is hardly a dozen well authenticated cases upon record. The only case which I have seen was that of a baby who was attacked when nine days old, and died at the age of sixteen days. It is true, that later, after two or three years, typhoid fever occurs quite frequently, but yet it is, in most cases, mild.

This is all that can be said here of the glands of the intestinal tract, for those of the large intestine have no other function than to produce mucus.

The muscular apparatus of the intestine is developed but slightly. The intestinal tract, from the stomach, which receives the first air with the first movements of deglutition soon after birth, down to the anus, has but little work to do during the whole of foetal life. According to Zweifel, the contents of the intestinal canal move only very slowly. In a foetus of three months, the ileum and colon are still empty. At the end of the fourth month there is meconium two centimeters this side of the cæcum. In the fifth month there are a few particles in the colon.

The inconsiderable development of the intestine gives rise to several difficulties soon after birth. Air which is swallowed, and gas which is developed in the intestinal tract, may be neither absorbed nor expelled, with colic as a result. Not infrequently the intestinal

muscle shows the first symptoms of a general morbid condition. For instance, rhachitis, when developed at a very early period in life, is very apt to show itself first in an unusual degree of muscular debility of the intestine. This debility will result in obstinate constipation very early.

This weakness of the muscle of the infant's intestine causes sometimes other disorders, for when the copious capillary system is not controlled by powerful muscular contraction, particularly when the muscular layer is thin and liable to be softened by œdema, passive effusion will easily take place. Besides, the nervous system of the infant is very irritable. The ends of the intestinal nerves are paralyzed by heat, irritated by local stimulation, and reflexes can be easily explained by the fact of the insufficient development of the inhibitory centres. Moreover, the formation of acids is very common, and these give rise to laxative salts, and the weakness of the sphincter ani is such that it allows the ready discharge, and thus prevents dessication, of the fæces.

The secretion of mucus is very copious. It ferments easily and acidulates. The alkaline intestinal secretion, the alkaline secretion of the liver, and the pancreas, become easily neutralized, and new acids are formed by putrefaction of what ought to have been digested.

The length of the infantile digestive tract is unexpectedly great. According to Beneke, the propor-

tion of the length of the body to that of the small intestine is, in the adult, 100:450; newly born, 100:570; second year, —:660; third year, —:550—600; seventh, —:510.

MECONIUM AND FÆCES.

Meconium consists of water, hair, tallow of the sebaceous follicles of the surface, of epithelium of the epidermis, and of the mucous membrane down to the intestinal tract, and of bile. It does not contain bacilli, but they are present from three to eighteen hours after birth, in consequence of the swallowing of air and the oral secretion. There are no products of putrefaction, and neither indol nor phenol are found. The same is the case in the first few months of life during normal nutrition. At a later period the lactic-acid bacillus is found in the intestinal tract, provided that milk-sugar is still present. Biedert has found a cocco-bacterium in the colon (Virchow's Archiv., vol. 100), which gives rise to a very faint odor. Altogether, infant fæces are not malodorous. Both of the above bacilli require but little oxygen, of which there is a small quantity in the infant's intestine. Under-normal circumstances other bacilli do not thrive. Thus it appears that the entrance of bacteria is not the cause of diarrhœa.

The number of normal evacuations in the newly-born infant is from three to five at first, from one to three later on. Their color is uniformly yellow, whiter when cow's milk, denser when starchy food is given. They are slightly acid, their odor is not unpleasant. In one of his excellent papers (d. Arch. Klin. Med., xxviii, 1881), Uffelmann gives the follow-

ing account of the microscopical contents of the fæces: A very large quantity of cocci and bacilli, and other fungi, fat globules and fat acid in crystals, protein substances, mucin, epithelia, mucus corpuscles, nucleated cells, structureless bodies, crystallized salts, cholestearin, coloring matter of bile, and sometimes bilirubin in crystals. The yellow color of the fæces is mostly attached to fat globules, fat acid crystals, epithelia, mucus corpuscles, and cocci. The fæces consists of small quantities of albuminoids, larger ones of fat, free fat acids, soaps, particularly those of calcium, salts of potassium, sodium, calcium, magnesium, iron with chlorine, and phosphoric, sulphuric and organic acids, also mucus, epithelia, cocci and bacilli, fermentation fungi, coloring matter, cholalic acid, cholestearin, and sometimes leucin and tyrosin. The percentage of water is larger than in the fæces of adults. Next in weight come cocci, epithelia, and mucus. Next fat and fat acid. Next salts. Of the (15 per cent.) solid constituents 1.5 are inorganic, and 13.5 organic. In these, fat and fat acid 2-3, protein 0.2 or less, and cholestearin 0.1-0.2. The normal food of the nursling is digested and assimilated to the amount of 96.5-97.0 per cent. Its protein to 99-100, fat 97-97.9, and salts 89-90 per cent. A part of the protein received reappears in the large volume of cocci and bacilli.

Amongst the micro-organisms the class of the schizomycetæ are numerously represented in the healthy and diseased intestine. Within from four to

eighteen hours after birth there are large numbers of bacteria, cocci, bacillus subtilis, and bacterium coli commune (Escherich), the latter in the large intestine, in the remnants of digested milk. Besides, there is the bacterium lactis aërogenes, to which is attributed the action of decomposing milk-sugar into lactic acid, carbonic acid and hydrogen, thus giving rise to the intestinal gases.

All these facts, showing the presence of immense quantities of micro-organisms, prove, however, nothing in regard to the etiology of diseases. The normal state exhibits the same. Besides, in some conditions where the most hazardous bacteriomaniac would not dare to believe bacteria the cause of the ailment, they are found in exorbitant masses. Thus, for instance, in arsenic poisoning, in which the intestinal part is crowded more than in any other condition, with saprophytes of the same class which inhabit the mouth, pass the gauntlet of the stomach's acid, and swarm about the bowels; or is perhaps the disease and death due to the micro-organisms, and the arsenic an incidental encumbrance ?

LIVER.

In the young embryo the weight of the liver is one-half that of the whole body; in the adult it is one-thirty-sixth of the whole weight. It is large in the foetus and also in the new-born.

Immediately after birth the circulation through the umbilical vein is cut off, but that of the portal vein increases. Thus, though it is very much smaller in the infant than in the foetus, the liver is still very large.

The inference, therefore, is that it should have a great influence on, and control of, the digestion of infants. But we know that the secretion of bile depends a great deal upon the presence of intestinal acids. Besides, at that early period, the formation of bile is not the principal function of the liver. During foetal life it is the organ that produces sugar. Sugar is as universal in the embryonic tissues as is fat in all the organs after birth. Salamon found in the liver of a baby killed by perforation, from 1.2 to 11.0 per cent. of glycogen.

The liver is probably also the seat of the formation of red blood-globules.

Its final function is to secrete bile. It is not improbable that the bile in the very young infant is as imperfect as is the secretion of the pancreas, for it consists largely of material destined for elimination,

and the quantity is proportionately small in infants who have to develop and increase their organs.

Thus, although the quantity secreted be copious, we must not expect too much effect on the part of the bile with regard to infantile digestion. In the very first week, transformation of the coloring matter is taking place. Bilirubin is formed, but some of the coloring matter is unchanged. At a later period, the transformation is complete. In anomalous conditions when the fæces become strongly acid, the bilirubin is transformed into biliverdin.

The different colors depend upon the different degrees of transformation. There is urobilin, which gives the color to the fæces in adults. There is also cholestearin in the intestine of the infant as in that of the fœtus and the adult, contrary to the opinion of Flint, according to whom cholestearin is transformed in the intestine.

PANCREAS.

The contents of the upper part of the small intestines near the stomach are still acid. But all the liquids which control intestinal digestion are alkaline.

The action of the pancreas is of different kinds. It changes starch into sugar, but the quantity of diastatic ferment in very young infants is but trifling. Still it is present when the baby is a few months old.

The second function of the pancreas is to change albuminates into soluble modifications.

The third function is to change fat into an emulsion.

The two latter effects have not been observed in infants that died of diarrhœa. Thus, it appears that the pancreas cannot be relied upon for any of its functions during severe attacks of diarrhœa. Fat is digested in such a way that it is decomposed into glycerin and fat acids. The glycerin combines with the phosphoric acid and forms glycero-phosphoric acid. The fat acids form soaps with the alkalies met in the small intestines.

Glycero-phosphoric acid contributes to the formation of cells in two ways. First, it forms lecithin, and second, it enters into the cartilage cells and forms phosphate of calcium out of the carbonate it meets there.

Now, the pancreas performs its function only while the intestinal fluids are alkaline. This alkaline reaction depends upon the presence of phosphate of sodium. When there is acid in the intestine, the pancreas is prevented from performing its function, and the formation of bone is delayed. But it is not only the bones which lack phosphoric acid in these cases, but the rest of the tissues, particularly the blood and the muscles. This condition, known by the general name of *rhachitis*, is therefore, sometimes, the result of primary absence of phosphates in the food, but very much more frequently of an excess of acid in the intestinal tract sufficient to wash out the phosphoric acid which it meets. Thus it is that rhachitis is generally found after chronic digestive disorders. The primary absence of phosphates is very rare. There are a few articles of food that do not contain a sufficient amount of phosphates to build up tissues. Thus, for instance, there is proportionately very little rhachitis in New York city, though the drinking water is almost deprived of calcium. The very fact that there was almost no rhachitis twenty or thirty years ago, and that there has been an increasing number of cases within the last five or ten years, proves sufficiently that it is not the drinking water, but that it is the increase of poverty with its unfortunate results as to the impaired condition of the general health of the babies.

In reference to the significance of calcium in food, Foster has reached the following conclusions:

For eleven consecutive days he fed a baby on 1217 cubic centimeters of milk containing 136.8 cubic centimeters of solid substances. In the fæces he found 8.67 per cent. of solid substances. Thus all the solids in the foods had been absorbed with the exception of 6.35 per cent. (11 per cent. in the adult). The fæces of the baby had neither albumin nor sugar, but contained from 30 to 40 per cent. of fat and fat acids; further 34 per cent. of acids, one-third of which was joined to calcium, and a large amount of carbonic acid. Thus a large portion of the fæces consists of soaps, particularly the soap of calcium.

The mineral constituents were absorbed least, and next to them the fat and the ashes of milk in general; of these there were in the fæces 36.5 per cent.; of the calcium in particular 75 per cent. In spite of that the baby thrived and increased in weight, in one week 170 grammes. Thus there appears to be but very little need of salts on the part of the growing baby. The baby receives in one day 1.25 grammes of calcium, of which there is an elimination of 0.92 grammes in the fæces and 0.03. in the urine of an infant two-and-a-half years old. There is then a balance of 0.3 grammes in a day, of 2.1 in a week, of a kilo, or two pounds, of calcium in a year. This is all that is utilized.

Almost the entire quantity of calcium in the body is deposited in the bones, which contain 11 per cent. of calcium in the adult, and in the infant and child somewhat less.

There are some very important practical points connected with the results of these observations.

As long as the food contains plenty of calcium and phosphoric acid, there certainly is no indication for the introduction of the same in the form of medicine or as an addition to food, for the purpose of improving nutrition. Thus the *combination of cod-liver oil with phosphate of lime*, which has become so fashionable, *is based on an illusion* concerning its alleged efficiency. Besides, the observation has been made also, at a very early time, that immediately after the administration of preparations of calcium, there was increased elimination through both the feces and the urine.

Thus when there is no actual absence of calcium phosphate in the food, the organism should be spared useless exertion. In occasional cases when the effect appears to be favorable, this very effect is different from what was intended. When rachitical or anæmic infants are supplied with phosphate of lime, and iron, bismuth, etc., they are generally patients who are suffering from primary or secondary catarrh of the stomach with superabundance of acid in the secretion. In these very cases the calcium phosphate acts as an antacid, inasmuch as phosphoric acid becomes free and the lime neutralizes the acids of the digestive organs.

It has been stated that the fat acids saponify the alkalies found in the intestine. When there are

enough alkalies to decompose the fat, but not a sufficient quantity to form soap, the result is the formation of free fat acids. When there is much free acid, all the alkalies of the intestinal fluids become neutralized, but particularly the potassium and the sodium of the bile, which is indispensable for intestinal digestion because of its antifermentative effects. Not only is the effect of the bile present in the intestine destroyed in this way, but it also appears that, in consequence of that very fact, less new bile is secreted in the liver itself. For the absorption of food is required for the formation of bile, which cannot be formed in sufficient quantity when the food is but incompletely disintegrated and not absorbed.

A moderate amount of acid appears not to be abnormal. It is liable, however, to become abnormal with great facility. For normal fæces are always acid. There are always lactic acid, palmitic, stearic, capronic, and caprylic acids present in the intestine.

Hoppe-Seyler also found free fat acid in the fæces of dogs and adults. Wegscheider found the same in nurslings fed exclusively on mother's milk. For what I said with regard to the pancreas proves that its power to digest fat is but limited, at a very early age.

With regard to this, Wegscheider has made direct investigations which are formulated by him as follows:

Fat is not completely absorbed. Part of it leaves

the intestine in the form of soap. Another portion is free fat acid. A third part remains unchanged.

There is a large amount of fæces, although the baby receives absolutely nothing but mother's milk. What has been called detritus in the fæces is not exclusively undigested casein, but principally fat, and a large portion is the remnant of intestinal epithelium. This so-called detritus is not soluble in water, in acid or alkalies, but quite soluble in alcohol and ether.

Casein is present only when it has been taken in too large quantities, or when there is too much free acid in the stomach. In these cases there may be large amounts in the fæces.

An important practical application of this fact is the following. As it is true that fat is not completely absorbed, even under the most normal circumstances, as free fat acids are so easily formed and accumulated; as they are found in moderate quantities even in healthy babies; as we know that a surplus is very apt to derange digestion and assimilation and that it even prevents the normal secretion of either of the digestive fluids; as there is a superabundance of fat in the normal food of the nursling, the conclusion is that we should be very careful in preparing artificial foods. It is very easy to give too much fat; it is hardly probable that there is too little.

It has afforded me great satisfaction to learn that O. Bollinger, in *D. Z. f. Thiermed*, 1880, p. 274, coincides with me in regard to the necessity of keeping

the fat in infant food down to a certain percentage. He says: "Generally cow's milk, which contains large quantities of fat, from four to five per cent., is considered the best. Now, Foster found that when a baby four months old was fed on cow's milk with a decoction of rice, in the proportion of 4 to 1, albuminates and sugar were absent from the fæces; that is, they were completely digested. But the baby passed undigested from 30 to 40 per cent. of the fat, and 34 per cent. of mineral constituents.

This experiment proves, with the greatest probability, that such cows' milk as contains less fat, thereby resembling woman's milk, is preferable as a food for infants.

It is also not improbable that the good quality of milk in the country, which, as a rule, is well tolerated by children and adults, is based upon the fact that its percentage of fat is not very great, and that thereby it becomes more digestible. For Professor Feser has found that Alpine milk, which certainly is produced under most normal circumstances, contains very much less fat than the milk produced in the neighborhood of Munich. Inasmuch as the morning milk has much less fat than the evening milk, the former is preferable for the purpose of feeding infants."

SYMPTOMATOLOGY OF INTESTINAL DISEASES.

The symptomatology of intestinal disorders exhibits a few symptoms which many of them have in common. The most frequent of them are colic, constipation, and diarrhœa.

COLIC

Colic is a pain that has its seat largely in the walls of the intestine. It finds expression in the features of the infants. They cry loud, continually or paroxysmally, and move their lower extremities to and fro, up and down. In the highest degree of the affection, however, the children will keep their lower limbs quiet, every movement being painful. They are sometimes very pale, go off in convulsions, and appear collapsed. Now and then there are spastic contractions of other parts, as for instance the scrotum. The attacks are intermittent, and frequently known to accompany digestive disorders. They are attended with flatulence which, when it inflates the bowels permanently, is called meteorismus or tympanites. Flatulency is more frequently found in connection with the cases attended by diarrhoea than with constipation. Not infrequently there is dyspnoea connected with it, which is the result of the pain that compels the child to keep the diaphragm immoveable. It has been said that when the seat of the difficulty is in the small intestine the abdomen appears pointed, and when in the large intestine it appears generally enlarged. I cannot say that I have noticed marked differences.

The causes of colic are fermenting food, gastrointestinal catarrh, the presence of a large number of ascarides, exposure to cold, cold feet, diminished tonicity of the muscular layer of the intestine, as in

general anæmia, and particularly in general rhachitis, and finally chronic peritonitis, which resulted in adhesions and anatomical changes in the intestinal tissue.

The symptomatic treatment, beside the occasional use of an antispasmodic or narcotic, consists in gentle massage, the application of dry heat, the administration of aromatic teas, freshly prepared, such as fennel, anise, German chamomile, catnip, *or* the injection of large quantities of such teas, quite warm, into the rectum. Care must be taken not to inject atmospheric air. The causal treatment is indicated by the intestinal disorders giving rise to it.

CONSTIPATION.

The embryonic intestine is formed in separate divisions. There is no ascending colon up to the fourth or fifth month of foetal life. It is very short in the mature new-born. Despite this, the large intestine of the mature foetus is longer in proportion than that of the adult. It is three times as long as the body of the foetus, while it is only twice as long in the adult.

There is the same disproportion with regard to the length of the small intestine. The small intestine of the foetus in the ninth month is twelve times as long as its body. The small intestine of the adult is only eight times as long as the body.

The colon ascendens being very short, the surplus of length, particularly as the transverse colon also is not long, belongs to the descending colon, and especially to the sigmoid flexure. Drandt found it between 8 and 24 centimeters in length, averaging from 14 to 20. I have seen a case in which it was 30 centimeters long.

As the pelvis is very narrow the great length of the lower part of the large intestine is the cause of multiple flexures, instead of the single sigmoid flexure of the adult. Thus it is that, now and then, two or even three flexures are found, and to such an extent that one of them may be found to extend as far as the right side of the pelvis. Cruveilhier and Sappey speak of

this position of the lower part of the intestine in the right side of the pelvis as an anomaly. Huguier finds it on the right side of the body in the majority of cases. Others only occasionally, although they admit the great length of the sigmoid flexure. In common with Huguier, who even proposes to operate for artificial anus in the right side, I have found one of the flexures on the right side many times.

This great length of the large intestine and the multiplicity of its flexures are of great functional importance. At all events, they retard the movement of the intestinal contents, facilitate the absorption of fluids, and thus the *fæces* are rendered solid. When this length is developed to an unusual extent, constipation is the natural result. In the *American Journal of Obstetrics*, August, 1869, I have described two cases in which the descending colon was so long that the diagnosis of imperforate rectum was made. In one of them the operation for artificial anus was performed. Such cases and such errors are certainly very rare, still they are those, in which normal anatomical conditions will lead to incidents of great pathological importance.

Other causes of constipation in the infant may be classed under four heads:

First.—The intestinal mucus is deficient or too viscid. Such is the case in febrile conditions, now and then in chronic intestinal catarrh, and also when there is too much perspiration and secretion of urine.

Second.—Improper condition of food. A superabundance of casein, particularly cow's casein, of starch, the absence of sugar, and the administration of astringents and iron.

Third.—Incomplete peristalsis, such as exists in the rachitic debility of the muscular layer, in the muscular debility dependent upon sedentary habits and peritonitis, intestinal atrophy and hydrocephalus.

Fourth.—Mechanical obstruction. Cystic tumors in the intestine will be treated of in another part of this book. There is, further, intussusception and twisting of the intestine, incarcerated hernia, even umbilical hernia, hardened fæces, imperforations.

In all these cases the diagnosis should not be made without manual examination. In most of the cases the abdomen is inflated, though it be painless. The fæces come away in small hard lumps or in large masses. The liver and spleen are displaced. The liver may be so turned that a part of its posterior surface comes forward. The abdominal veins are enlarged to such an extent that they form circles around the umbilicus, similar to what is seen in hepatic cirrhosis. These children lose their appetite, sometimes vomit, and the irritation produced by the hardened masses in the intestinal canal may be such as to finally result in diarrhœa, which, however, is not always sufficient to empty the tract.

There is, besides, an apparent constipation, which

should not be mistaken for any of the above varieties. Now and then, a child will appear to be constipated, have a movement every two or three days, and at the same time the amount of fæces discharged is very small. This apparent constipation is seen in very young infants rather than in those of more advanced age. Such children are emaciated, sometimes atrophic. They appear to be constipated because of lack of food, and not infrequently this apparent constipation is soon relieved by a sufficient amount of nourishment.

Constipation resulting from a superabundance of starch in the food is easily cured by the withdrawal of the latter.

Constipation produced by too much casein in the food will be relieved by diminishing its quantity. The proportion of casein in the food of infants should never be more than one per cent. Besides this amount of casein ought to be copiously mixed with a glutinous decoction.

Infants that have been fed on starchy food or even such cereals as barley, should have oatmeal substituted for the barley.

Constipation depending on lack of sugar is very often speedily relieved by increasing the quantity of sugar in the food. This is the case, not only in artificial feeding, but also when the children are fed normally on breast-milk. Such mother's milk, as is white, and dense, and contains a large amount of casein,

is made more digestible, and will produce better evacuations, when a piece of loaf sugar dissolved in tepid water is given immediately before nursing.

Very little medicine should be given in all these forms of constipation, in infants or children. The best, after all, may be magnesia, as there is frequently too much acid in the intestinal tract of the young. It will at the same time neutralize the acid and relieve the bowels. Whenever an addition is necessary, rhubarb will suffice. In most cases an enema will be sufficient to relieve constipation. It should be given every day for a long time. There is a prejudice against rectal injections which is unfounded. They should not be given too hot not too cold. They may contain a small quantity of salt, so as to make a two-thirds of one per cent. solution.

In those cases where constipation is very obstinate, the enema should be given through a tube from four to six to eight inches in length. Beyond that it is usually impossible to introduce a tube.

In very serious cases, particularly in those which depend upon an unusual length of the sigmoid flexure, it is sometimes necessary to remove the hardened fæces by means of the finger or a spoon.

Massage has already been mentioned amongst the remedies. Electricity has been successfully used, when constipation was the result of insufficient peristalsis. But lately, E. Schillbach (Virch. Arch. vol. 109, Aug. 4th, 1887) found that the several portions

of the intestinal tract respond differently to the application of the faradic and galvanic currents. In general, moderate galvanic currents have a stronger effect than moderate faradic ones. Local contractions result from the negative pole ("Kathode"), peristaltic waves from the positive ("Anode"). Thus for the relief of obstinate constipation the former ought to be applied in the rectum, the latter over the abdomen, along the colon.

PREDISPOSITION TO DIARRHŒA

Healthy infants have a normal tendency to loose, liquid and semi-liquid evacuations from the bowels. The cause of this looseness of the bowels lies partly in the condition of the intestinal tract and partly in the nature of the normal food which is breast milk. Peristaltic movements in the healthy child are very active. The young blood and lymphatic vessels are very permeable, and the transformation of the surface cells is very rapid. The peripherous nerves are very superficial, more so than in the adult, whose mucous membrane and sub-mucous tissue have undergone thickening by both normal development and morbid processes. In the young infant the peripherous ends of the nerves are longer in proportion, than in the adult. The anterior horns of the nerve centres are more developed than the posterior ones. Thus through the deficiency of development of the inhibitory centres, the greater reflex irritability of the young, particularly with regard to intestinal influences, is easily explained. Besides, the action of the sphincter ani is not very powerful; the fæces are not retained in the colon and rectum, and but little time is generally afforded for the reabsorption of the liquid or dissolved fæcal contents.

Moreover, the frequency of acids, sometimes normal, in the small intestine, gives rise to the formation of alkaline salts with purgative properties. Hoppe-

Seyler found free acids in the fæces in dogs and the human adult. Wegschneider met them in nurslings who received nothing but mother's milk. An explanation of this occurrence may be found in the fact that the quantity of food is often too large; but in many instances the amount of digestive fluid is too small, and thus gives rise to a fermentative process in place of normal digestion. Moreover, the diastatic effect of the pancreatic juice is limited at very early age, and undigested material is carried off.

FAT DIARRHŒA.

Under the head of fat diarrhœa German journals and a few text-books speak of a diarrhœa, the chief characteristic of which is the presence of a large quantity of fat in the stools.

The normal fæces of the newly-born contain ten or twelve per cent., sometimes more, of fat. In abnormal cases even when the food does not contain a surplus, the fæces may exhibit from 40 to 70 per cent of fat. The fat in these cases is not saponified, but free.

The anatomical condition of the intestinal tract may vary in fat diarrhœa, but, in the majority of cases, we have to deal with a simple catarrh.

The microscope reveals in serious cases fat almost to the exclusion of everything else; sometimes pure, sometimes in needle-like bodies. Biedert and Demme have given this subject special attention.

The causes are changes in, and exfoliation of, the epithelium of the small intestine; swelling of the mucous membrane of the duodenum, thus resulting in an obstruction to the flow of bile and pancreatic juice; hyperplasia of the mesenteric glands by which the chyle circulation is impeded to such an extent that the chyle vessels are empty.

As can be seen at once, all these conditions are or may be the result of intense catarrh with its consequences. Finally, in a very few instances, anatom-

ical changes in the pancreas have been well known to interfere with the emulsion of fat at any age.

Any improvement of the condition is impossible unless the quantity of fat contained in the food be largely diminished. That the indications for casual treatment are given by the condition of the intestine and pancreas, is self understood after all. After all, it is not wise to swell the headings in our treatises by the introduction of a new chapter.

ACUTE INTESTINAL CATARRH.

Gastric catarrh may descend, and catarrh of the rectum or colon may ascend, but catarrh will also originate in the small intestine, sometimes in the duodenum, the jejunum, or the ileum.

The causes are food, given in improper quantity or quality; improper artificial food mostly. But even mother's milk may cause it. Mothers who are sick, or convalescing, or the subjects of very strong emotions, who nurse too often, who suffer from tuberculosis or syphilis, who are pregnant, some who are menstruating, and all anæmic persons, secrete improper milk. The colostrum secreted immediately after child-birth is apt to give rise to diarrhœa. Milk containing too much fat, or too many salts, as is the case in anæmia alluded to above, is liable to produce the same effect.

Infantile age, moreover, is very sensitive, more sensitive than advanced age, to the heat of the summer, the influence of the diminution or increase of atmospheric moisture, and the settling of ground water.

Besides, the mucous membrane with its lymph vessels is more irritated by the results of fermentation, such as phenol, indol, scatol, bacteria and bacilli.

Further causes are the direct influence of purgatives, or those medicines, like arsenic or corrosive sublimate, which are not tolerated either on account of idiosyncrasy or when given in improper doses.

Other causes are infectious influences, such as

exposures to cold, typhoid fever, dysentery, and severe forms of malaria.

Finally, disturbances of circulation, of the liver, lungs, and heart, which predispose to passive hyperæmia of the intestines.

Autopsies are not very frequent, except in the bad cases complicated with acute gastric catarrh, and described as gastro-intestinal catarrh, or "cholera infantum," mostly during the summer. The local changes in the mucous membrane may be superficial or deeper. The mucous membrane is injected and of a pink color. It is often thickened, and its vessels are very distinct. The epithelium is often absent, though this change is frequently cadaveric. It is covered with mucus. The glands are more prominent, and contain a large number of recently proliferated cells. The follicles of Lieberkühn in the colon and rectum are filled with mucus or are ulcerated. Some of them are in cystic degeneration. Peyer's patches are also filled with mucus and enlarged. In some parts of the mucous membrane the erosions are pale and form what has been called catarrhal ulcerations. The connective tissue being hyperplastic, does now and then give rise to polypoid excrescences. The mucous membrane, however, may, in protracted cases, undergo atrophy; particularly does this occur in the neighborhood of the glands, which may disappear entirely. The muscular layer, also, may undergo atrophy, particularly in the colon and ileum.

Symptoms.—There is fever, also diarrhœa and pain. When the affection begins in the stomach, there is vomiting. When the catarrh descends to, or begins in, the rectum, there is tenesmus. The evacuations in the beginning contain remnants of food, and have a stronger odor than normal fæces. Afterwards the evacuations are liquid, light yellowish or brownish in color, strongly acid, but later of an alkaline reaction. In the evacuations there are many specimens of *bacteria*, none of which is characteristic of the affection, epithelium, mucus, sometimes pus, and remnants of food of all kinds. The percentage of water in the evacuations is very large, amounting to 90 to 95 per cent., while the percentage of water in normal fæces of the nursling is 85 per cent., and, in older children, 80 to 75 per cent. Particularly is the percentage of water large in all these cases of diarrhœa which depend upon, or are complicated with, disturbances of the circulation. The babies are pale, and draw up their lower extremities.

The odorless condition of the evacuations changes, very soon, for it becomes fecal, afterwards acid, and in protracted cases, of so-called follicular enteritis, it is cadaveric.

In the beginning of the disease there is sometimes herpes labialis. The urine is diminished in quantity, but the secretion is entirely arrested only in the very worst cases of choleraic diarrhœa.

In a few cases recovery is quite rapid. In others

the disease terminates in so-called follicular enteritis, or in chronic intestinal catarrh.

Its complications may be various. Not infrequently is it complicated with bronchial catarrh, broncho-pneumonia, and with peritonitis very much more frequently than is generally supposed. Many of the belly-aches of grown up children are new attacks, more or less severe, of peritonitis, dating from a diarrhœa of early infancy and childhood. One of the frequent results of gastro-intestinal catarrh, either acute or chronic, in very young infants, is general peritonitis.

When there is diarrhœa, we have to conclude that, in most cases, the upper part at least, of the colon is affected. Food remnants will require two or three hours to pass from the pylorus to the cæcum, and at that time it is always liquid. In normal conditions the evacuations are not of this character.

Thus, when they are quite liquid, an affection of the upper part of the colon necessarily exists, at least such a one as results in undue peristalsis.

Duodenal catarrh can be diagnosticated only when it is complicated with jaundice. It never gives rise to diarrhœa. That of the jejunum and ileum is seldom isolated without the upper part of the colon participating in the process. It must be supposed that they are included in the disease when the stomach is affected. When the fæces are fairly solid and contain conglomerate masses of mucus thoroughly mixed with the

faecal masses, we make the diagnosis of isolated catarrh of the small intestine.

Further, when the faeces contain a great deal of undigested material we may also conclude that we have to deal with a catarrh of the small intestine complicated with catarrh of the stomach. This is the condition in which undigested food is seen in the faeces and called *lientery*.

But it must be remembered that gastric catarrh alone, with anæmia and with abnormal peristalsis of the stomach and upper part of the small intestine, is of itself able to propel undigested food with abnormal rapidity.

When there is bile in the passages, of a green color, yielding a distinct reaction with nitric acid, the bile being attached to the mucus and cylindrical epithelium and round cells, we have also to conclude that the catarrh has its seat, in part at least, in the small intestine, as under normal conditions there is no bile in the large intestine, or but very little. As stated above, there is, as a rule, a part of the colon affected at the same time with the small intestine.

It has been stated that, when there is considerable peristalsis and rumbling, perceptible by palpation or audible, it is in the middle of the abdomen and its lower part when the affection is in the small intestine; that it is lateral and in the upper part, when the large intestine is involved. Still, neither pain nor locality is absolutely pathognomonic. But there is one condi-

tion that is. When the mucus is not thoroughly mixed with the fæces, when the fæces are wrapped up in it, or the mucus covers the fæces after evacuation, that mucus comes from the colon, and we have to deal with a catarrh of the colon. When the fæces are still solid, the catarrh may have its location in the lower part of the colon.

As a general rule acute catarrh of the lower part of the colon generally furnishes pure mucus mixed with blood, particularly in the catarrhal form of dysentery. When the secretion from the colon is very considerable, the passages are evacuated more or less frequently, in large quantities or smaller ones, suddenly and with a gush, and, as a rule, without tenesmus. Tenesmus is observed only when the lower portion of the rectum is involved in the morbid process.

Thus, common catarrh of the colon must not be mistaken for the other form which has been called

MEMBRANOUS ENTERITIS.

Cases of this affection are not very frequent even in the adult. There are many authors who do not mention it. Thus Beaumetz, Damaschino, Habershon, Nothnagel. Vidal, however, Wilks and Clark, Perroud, Beale, DaCosta, Goodhart, and some of the text books, mainly Pepper's *Cyclopædia*, discuss it. A very good exposition of the subject is found in the *Medical and Surgical History of the War of the Rebellion*, Vol. II, p. 1, 1879. The morbid specimen forming the main symptom of the disease is a dense membrane, several inches long, in rare instances a foot long, flat, or often cylindrical, exhibiting a cast of the whole intestine. It is sometimes tenacious and viscid, mostly quite firm, so that a cylinder many inches long may be raised on one end without tearing off. It consists mainly of mucus of a very dense and hard nature, with very little serum left, with some little fibrin, a hyaline granular matrix, some white blood cells, and columnar epithelium. Thus it cannot, must not, be mistaken for a general diphtheritic enteritis which now and then is met with in the small intestine, but more frequently in the colon. The latter, mainly in its lower part, forms the more serious and dangerous form of the dysenteric process. In membranous enteritis the mucous element, prevails over all others. Still, there are cases in which this muco-membranous form is mixed with, or is transformed

into, the later fibrino-membranous form; it is well known that a sore mucous membrane, a chronic catarrh yield the very opportunity for diphtheritic deposits. Most of the children who suffer from membranous enteritis, as are also the (men and) women—it being mostly found in the latter—are neurotic.

The *prognosis* of acute intestinal catarrh is favorable when the babies are at the breast, or artificial food is well selected, when they are not too young or feeble, and the necessary intelligent care is bestowed upon them. It is unfavorable when the infants are very young, only a few days or weeks old, when they are bottle-fed, and their food is poorly selected; when their nutrition and care has always been bad; when they are rhachitical; when they have had some disease previously; also in large cities in the summer. Complication with peritonitis is very unfavorable when the latter is acute. Complication with chronic peritonitis threatens relapses.

TREATMENT.

Internal medication.—Empty the stomach and bowels of fermenting masses. The castor oil of the lay public answers well. A dose of calomel (grs.j-vj) answers better, because it acts as an anti-fermentative, besides being a purgative.

Neutralize acids (fat acids) in the stomach. Carbonate or phosphate of calcium, grs. j-ij, every one or two hours, acts as an adjuvant to other treatment.

Bismuth also answers this indication, besides being an antifermentative. Dose, grs. ss-ij every one to two hours. May be combined with opium. Dover's powder, grs: $\frac{1}{10}$ - $\frac{1}{5}$ - $\frac{1}{3}$, every one, two to four hours, when the odor has improved. No salts of magnesium or sodium, because they add to the diarrhœa in these acute cases. Avoid syrups to correct the taste of medicines. They will turn sour. Prefer glycerine.

*Anti-fermentatives.**—Calomel, bismuth, alcohol, creasote, salicylate of sodium, and resorcin have been recommended for their anti-fermentative effect. Of the two latter I prefer resorcin, iv-x grains a day, in solutions (suspensions), or as a constituent of powders (with bismuth, chalk, opium).

*The practice of giving anti-fermentatives has preceded its theory for centuries. Still the theory is not quite so recent as a few modern journals appear to believe. In "Treatment of Infant Diarrhœa and Dysentery," by A. Jacobi, M.D., in American Journal of Obstetrics, etc., July, 1879, there are the following remarks:

"A further indication is to destroy ferments. For that purpose most metallic preparations will do fair service. One of these is calomel * * * as to its effect as an anti-fermentative there can be no doubt. * * * Possibly, it acts by a portion of the drug being changed slowly into the bichloride of mercury."

"Alcohol certainly arrests fermentation."

"Sometimes, particularly when the stomach can be relied on, the salicylate of sodium may be added to the internal treatment. * * * The salicylic acid may prove beneficial, both by its antifebrile and disinfectant action."

Sedatives.—Opium depresses hyperæsthesia, hyperperistalsis, and hypersecretion. Dover's powder (gr. $\frac{1}{10}$ to $\frac{1}{3}$ every two to three hours) acts very well, though some writers object to it, and is indispensable when the odor begins to be normal. Does well with bismuth, and prepared chalk, with or without resorcin.

Astringents.—In acute cases, and when the stomach participates in the process, lead, tannin, gallic acid, alum, etc., are badly borne. In chronic protracted cases they will find their indication. Nitrate of silver does better in many cases, gr. $\frac{1}{30}$ th to $\frac{1}{30}$ th in 2 drachms of distilled water (dark bottle) every two hours. Creasote water in chronic cases, $\frac{1}{4}$ to $\frac{1}{2}$ teaspoonful several times daily.

Stimulants.—Alcohol may be admixed to food. Bad brandy or whiskey contains fusel oil, which is a paralyzing agent. Whiskey is therefore preferable with us, because it can be obtained in greater purity for less money. (See under "Food.") Never give it raw. Camphor is better borne than ammonia. It is easily taken when simply rubbed off with glycerine suspended in mucilage (gr. $\frac{1}{4}$ -ij every one to two hours). The strongest nerve stimulant of all is *Siberian* musk. Give in *urgent* cases of collapse gr. i-ij every fifteen or thirty minutes (best suspended in mucilage) until six or twelve grains have been taken. A very good stimulant in collapse is the injection into the bowels through a long flexible tube (catheter No. 12) of hot water with some alcohol, and one or a few drops of tinct. op.

EXTERNAL APPLICATIONS AND HYGIENE.—In acute cases with high temperature applications of water of 60° - 70° to abdomen. Where much pain and with anæmic children, warm applications do better. Frequent injections of water of 100° F. answer well in most cases, not only in rectal catarrh. In collapse or great debility, the water ought to be from 105° to 112° F., and contain some alcohol and opium. Part of this water will be absorbed, fill the blood-vessels, and may prevent intracranial and other thromboses. The addition of gum arabic to the injection, or the use of glutinous decoctions (flax seed) instead of water is quite satisfactory. Open doors and windows in hot weather. Select the coolest place in the neighborhood for the patient, day and night. Night air is better than no air. Country air, sea air, better than city air, particularly at some altitude. When the body is warm and the weather hot, wash the body with cool water, or alcohol and water (1:5) frequently. Cold feet must be warmed artificially.

Food.—No raw milk, no boiled milk, no milk admixture at all, in bad cases. In vomiting and severe diarrhœa, total abstinence for from one to six hours. Afterward teaspoon doses of a mucilaginous or farinaceous decoction. Regular food: 5 ounces of barley-water, 1-2 drachms of brandy or whiskey, the white of 1 egg, salt and sugar, teaspoonful every five or fifteen minutes, according to age and case. May be mixed with mutton-broth, which, with white of egg,

etc., is better than beef soup or beef tea, in convalescence. Abstinence better for vomiting than ice ; the latter may quiet the stomach, feel pleasant, but stimulates peristalsis. Avoid beef-tea. If it be given in convalescence, mix it with barley-water.

Toward the end of the disease, or when the discharges are many and copious, and inspissation of blood, and thromboses (hydro-encephaloid) threatening, the common sense of the practitioner will introduce liquid into the circulation as best he can. No written rule ever supplies or substitutes brains.—
(*Medical News*, July 9, 1887.)

FOLLICULAR ENTERITIS.

It has been stated that in all catarrhal conditions of the small and large intestines, the follicles participate in the process. That is particularly so in chronic cases.

This follicular enteritis is simply an aggravation of a common catarrh, originating in the ordinary causes acting in the summer season, in early infancy, but less so in the cooler part of the season and in older children.

This peculiar form is seen not infrequently when the system has been impaired by infectious diseases, such as measles and scarlatina.

The pathological changes are those of catarrh, but the most severe alterations take place in the solitary follicles and Peyer's patches. Both of these are enlarged and prominent, and grayish or grayish-red. Peyer's patches are surrounded by a red zone; now and then ulcerations are found.

The microscope reveals a large number of newly-formed round cells, disintegrated or not. In the ulcerations there are large masses of detritus and bacteria. The lymph vessels and the lymph bodies participate as in every severe form of intestinal catarrh. Particularly is there a large amount of acute and chronic tumefaction of the mesenteric glands.

The *symptoms* vary according as to whether this particular form is connected with acute or chronic in-

testinal catarrh. In the first variety there is fever, diarrhœa, frequent and copious discharges, all accompanied by pain. The inclination to evacuate the bowels is constant and there is some tenesmus. When the latter is present, the passages are small, greenish, foamy, have an insipid, musty, and, after a while, cadaveric odor, are covered with mucus, some blood and pus. Real hemorrhage is rare.

Under the microscope there are seen mucus and blood cells, pus cells, round cells, unchanged, or undergoing disintegration, bacilli, and bacteric zoogloea.

The symptoms are liable to increase very rapidly. Complication with pulmonary diseases and peritonitis are not infrequent. Although the disease is a very serious one, slow recovery may take place.

When the disease originates in chronic intestinal catarrh, it generally runs its course without fever, or with occasional exacerbations of temperature. The diarrhœa is of the same character, and contains much pus. There is not so rapid an emaciation in the chronic as in the acute form; still, emaciation gradually increases and becomes well-marked. The skin loses its elasticity, and it can be easily raised up in folds and does not for a long time return to its normal position.

The diagnosis of follicular enteritis is made from the pain, the speedy development of bad symptoms, the early emaciation and the condition of the passages. It must not be forgotten, however, that there is more or less participation, on the part of the follicles, in

every case of intestinal catarrh, and it is a matter of *doubtful convenience* to speak of follicular enteritis as a special form.

Prognosis.—This severe form, a generalized catarrhal enteritis, is more apt to terminate fatally than the common variety. The prognosis is worse when there has been diarrhœa before; when the children are rachitical, anæmic, or have suffered from other diseases; when they are very young; when the fever is high; when there are complications with bronchitis, pneumonia, or peritonitis. Some of the children are spared a long time, and finally succumb to intestinal ulceration. The treatment consists of meeting the same indications as in acute and chronic catarrhal enteritis in general. It is less promising because the anatomico-pathological lesions are more severe.

CHRONIC INTESTINAL CATARRH.

The causes of this disease are essentially the same as those of acute intestinal catarrh. It occurs mostly in nurslings in which both the anatomical structure and the physiological functions of the intestinal tract are still imperfect. The affection is liable to become chronic when the alimentary disturbances have not been very severe, but rather of a light character and frequently repeated.

Artificial food, improperly selected and prepared, which is not digested and absorbed, undergoes fermentation and irritates the mucous membrane.

When the effect is slow and persistent, the final changes are atrophy, that is, emaciation of the whole body.

The mucous membrane of the intestinal tract is rather pale, loose, and its folds are large. The submucous tissue is full of new cell proliferation. So are the solitary glands and Peyer's patches. They are pale and prominent, sometimes to a great extent, and some of them may be ulcerated. The visceral lymph bodies are very large, hard, white on section, and finally undergo atrophy. The liver is large and fatty. If vascular hyperæmia have been present during life, it is not very preceptible after death. Not infrequently are there complications with tuberculosis in other organs, and there are cerebral thromboses. The surface of the brain is intensely congested, and the

pia mater œdematous. The whole body is frequently rhachitical, and emaciation may be so marked that nothing but skeleton and skin appear to be left.

There are from five to ten liquid stools, alkaline or acid, daily. They are feculent or of bad odor, greenish, mixed with white flocculi and casein or fat. They contain bacteria and zooglœa, remnants of food, epithelium, mucus in the well-known shape of sago, sometimes blood, some albumin, cholesterine. The ashes amount to about 20 or 25 per cent. When the diarrhœa is alkaline, it contains mostly the phosphate of ammonium and magnesium; when acid, fat acids.

There are a great many attacks of colic. The abdomen is either distended and tense or soft; sometimes depressed and flat. The liver is very perceptible to touch; so, in many cases, is the spleen. The children are thin and flaccid, the skin folded, and pale, ribs very perceptible, the tongue furred and red along the borders. After a while the face becomes old, senile, the fontanelles are depressed; the pulse becomes small and frequent, the mouth dry and red, the voice hoarse, the eyes large and staring, the surface cool and œdematous, and sometimes exhibits the hardness of sclerema, and the baby becomes apathetic.

When the diarrhœa has its origin in the small intestine mostly, it appears to be more copious and there is more rumbling of gas. When the colon is chiefly affected or equally so, the stools are less copious but more frequent, and expelled with a gush, and sometimes there is tenesmus.

The babies are apt to die of general exhaustion, the pulse getting smaller and gradually disappearing, or of complications with respiratory diseases or convulsions. These convulsions are not infrequently due to the so-called *hydrencephaloid* of Marshall Hall, which usually means thrombosis of the small cerebral veins, depending on insufficient circulation and general anæmia, also on passive œdema of the pia-mater stretched over the emaciated brain.

Prognosis.—There are some of these cases, even fully developed, and though the skin be so poorly nourished as to produce intertrigo, acne, furuncles and general erythema, and the tongue so impaired as to exhibit fissures in, which after all recovery takes place. The prognosis, however, in far advanced cases is mostly bad.

Treatment.—This has been forestalled under the head of acute catarrh. Proper nutrition and the selection of proper remedies is as important here, as it was there. A number of cases in very young infants will get well only when a wet nurse has been substituted for any artificial food. Astringents are more frequently indicated here than in acute catarrh. The general indications, however, remain the same. Chronic catarrh of the large intestine requires local treatment, as indicated above, such as large irrigations with aromatic teas, or with or without astringents; or astringents in small quantities, say a solution of alum of from $\frac{1}{4}$ to $\frac{1}{2}$ per cent., or bismuth in the way mentioned under the head of intestinal ulcers.

Chronic catarrh of the large intestine, particularly the cases in which finally diarrhoea and constipation alternate with each other, does well under the influence of Carlsbad waters, half a wineglassful, or less, three times a day.

ULCERATIONS IN THE INTESTINES.

There are chronic catarrhs of the intestinal mucous membranes in which the cellular infiltration is so copious as to result in actual *suppuration*. Then the tissues undergo a multiple local mortification, ending in ulceration of the surface. In rare cases these abscesses and ulcerations are submucous and fistulous. When this process is very extensive, it *looks very much like a diphtheritic affection*, inasmuch as the surface, particularly of the elevations of the mucous membrane, looks grey and membranous. When the scabs are thrown off, ulcerations remain behind. When during all this time an exudation of cells, serum, and fibrin has been deposited, the resemblance to diphtheria is very strong indeed. A mistake is the more easily made in the diagnosis, as genuine diphtheria is found in the small intestine, though in exceptional cases only. For, as a rule, diphtheritic processes are found in the lowest part of the small intestine, and in the colon and rectum, and then go by the general name of dysentery.

The lymphadenoid tissue of the intestine, that is, the solitary follicles and Peyer's patches, participate in many of the morbid processes of the bowels.

When the inflammation invades the follicles by preference, the process is called, as stated above, follicular enteritis. The lymph bodies swell considerably by proliferation of cells, and through accumula-

tion and pressure upon each other, disintegration begins in the centre of those which are enlarged. Thus ulcers are formed of a hollow or scooped-out appearance.

Dysenteric ulcerations are quite frequent both in their acute and chronic forms. Either are dangerous, both in themselves and by their possible consequences, as for instance, abscess of the liver. The *catarrhal* and the *diphtheritic* forms cannot always be distinguished from each other. Often they are found together. The ulcerations may be superficial, deep, or undermined, the loss of substance small or large. The lymphadenoid bodies participate in the process almost always.

The *typhoid* ulcerations, when the disease is less mild than usual, have their seat, as a rule, in the lower part of the small intestine, about the cæcum, and in the upper part of the large intestine; sometimes higher up in the small, very frequently lower down in the large. In some epidemics relapses are very frequent, in these the colon transversum, descendens, and even the rectum, are invaded by ulcerations. Thus we may find the different stages of ulceration in the different parts of the intestine at the same time; cicatrization in the earlier ones of the cæcum, scooped out ulcers in the transverse colon, cellular recent infiltration in the descending colon, and rectum.

Around these ulcerations there is a considerable amount of hyperæmia. As a rule, they are confined

to the patches of Peyer and solitary follicles, and their immediate neighborhood, but the surrounding mucous membrane is often invaded, and the defects of substance become very large, particularly about the cæcum. Usually the mucous and submucous tissues are the only ones which undergo destruction, but the muscular and serous layers will also ulcerate, and then perforation may ensue. It is worth while to remember that diarrhœa is not required when there is ulceration. There may be *ulceration and perforation without any diarrhœa*.

Such was the case in a girl of eleven years, a patient in ward 28, in Bellevue Hospital. She was under observation for more than two weeks. During all this time she had no loose passages; on the contrary, now and then she had marked constipation, which required injections. She died suddenly of acute general peritonitis. Such peritonitis is the result of perforation, as a rule. But local peritonitis is often found without it. In this case we found a grayish-white discoloration and thickening of the serous membrane opposite the ulceration. That is a dangerous condition for two reasons. It may give rise to sudden perforation during entire health, apparently, months and years after typhoid fever, and also repeated attacks of peritonitis which later on may prove fatal. I have now under observation a boy, twelve years of age, who suffered from severe typhoid fever last October and November. He recovered entirely as it

seemed, but he never regained his full strength. His appetite was whimsical. The voracity of patients who have gone through typhoid fever never showed itself in his case, and his health was never as it was before the attack. On the contrary, he complained, sometimes every day, sometimes every week, of severe pain in the right side of the abdomen, occasionally extending all over the abdomen. This pain is complicated with constipation, increases on pressure, is now and then attended with elevation of temperature, and is best relieved by absolute rest in bed and the use of warm applications. Meanwhile the boy is pale, looks rather haggard and has never regained his weight. He is the subject of chronic peritonitis with adhesions.

Nor is peritonitis infrequent after protracted diarrhœa. Many years ago I presented to the New York Pathological Society a specimen of intussusception of the bowels, which reached all the way down from the transverse colon into the rectum, so as to be easily accessible to the finger. It proved to be irreducible, and at autopsy it was found that the serous membrane of the enveloping part had been torn in half a dozen different places. The rents in some places reached down to the muscular layer. These rents or partial perforations of the serous membrane and muscular layer were evidently due to changes in the serous coat which showed white discolorations, rather stiff and hard deposits in the tissue, and,

were evidently, the result of chronic peritonitis from which the patient had suffered a long time ago.

In the beginning of the disease, it was stated that the boy had always been healthy, but when questioned afterwards it was found that, in two summers, the child had suffered from protracted and severe diarrhœa, in which the intestinal catarrh had evidently not only affected the mucous membrane but had penetrated the muscular layer and thickened and changed the structure of the serous membrane.

Intestinal ulceration is by no means quite rare in children suffering from typhoid fever. This latter assumes with us an undefined character, is quite often diagnosed by exclusion only, exhibits little or no diarrhœa, sometimes but little roseola or splenic enlargement. What it lacks, however, in intensity, it has in duration. In the young it has quite frequently few and mild symptoms, but a protracted course. Nor is the same course rare in the adult. Long duration, lack of caution in feeding, particularly solid food while the intestinal ulcerations have not yet healed, prevent these from getting well, and being about, and eating *ad libitum*, does certainly not allow them to do so. Many a "chronic diarrhœa," or marasmus, or "consumption of the bowels," date from a typhoid fever, and prove again and again that the slightest morbid symptom, having a definite cause, requires its definite diagnosis, and demands relief and removal. Every diarrhœa has its cause, which must be considered removable.

I am positive that I see every year half a dozen cases of chronic diarrhœa which can be traced back to typhoid fever.

Tubercular ulcers are mainly found among adults. They show less tendency to heal than any other form of ulceration. The infiltration of the lymphadenoid bodies, mainly between the cæcum and rectum, develops into either circular or irregular ulcers which are apt to increase until a fatal termination takes place. In children they are not frequent, but they do occur. I have seen dozens of cases.

Perhaps the most extensive ulcerative process is set up in the shortest time by *septic* enteritis, brought about by swallowing putrid material in large quantities. I have never seen them so bad as I met them in some of the victims of that summer hotel at Lake Mahopac more than a dozen years ago, where the boarders had to drink their own diluted fæces.

Of a similar, though milder, nature are all those ulcerative processes which are the result of *protracted previous constipation*. Many causes will here combine to produce ulcers, namely: pressure of hardened fæces with accompanying chronic hyperæmia, and the presence of septic gases which cannot be either expelled or absorbed, because of the semi-paralyzed condition of the intestinal tract and of the physiological interruption of peristalsis at the cæcum.

In another part of this book I have shown one of the causes of serious constipation, in the very young, to

consist of an extraordinary length of the sigmoid flexures.

In one such case I have seen, when the child was three or four years old, intense chronic and fetid diarrhœa following the constipation of a life time. In that case I felt that the persistent locking up of the intestine was the cause of ulceration. The regular daily administration of an enema would have prevented the sad termination of a condition which became pathological, from an excess of normal physiological development—by neglect.

Syphilitic ulcerations are rare in the small intestines and colon, but they and nodular conglomerates which had not yet undergone disintegration, have been met with. Intestinal syphilis is mostly found in newly-born infants, suffering from hereditary syphilis. In them there are gummata in the patches or near them, which change into ulcerations, and sometimes cover the whole mucous membrane circularly.*

Foreign bodies are apt to give rise to ulcerations. I have seen them in the duodenum, in consequence

* Gummatous infiltrations of the rectum, generally of circular form, are found in the rectum of the adult. They give rise to stricture, and deep ulcerations. Gummata terminating in disintegration, abscesses and ulcerations, are also found in the cellular tissue behind the rectum from which at that place it is not separated by peritoneum. Ulcerations of the anus and sphincter are sometimes seen by primary infection. In former years I have seen quite a number of each, mostly in women.

of pressure by big gall-stones (in the adult only), in the colon, by the presence of hard fæces in the rectum, and about the sphincter by prune stones, glass-pearls, coins, in children and adults, and one deep traumatic ulcerations from a stick three inches in length, such as are used by the butchers to hold roasts together, and which had been swallowed by the "lady." Before a section of the New York Academy of Medicine I presented, a few months ago, above one-fourth of the material contained in the intestine of an infant suffering from chronic diarrhœa in the service of Dr. B. Scharlau, Mount Sinai Hospital. It consisted of about an ounce of worsted yarn, such as is used for the knitting of coarse stockings. *Entero-liths* I have seen a few times, resulting in ulcerations, in adults, but a single time only in a child of five or six years.

Treatment.—In acute cases of dysentery great sensibility of the left hypogastric region and heat will be alleviated by the application of ice. Very young infants, however, bear ice but a short time, whether applied to head or abdomen. I advise to watch the effect of the application either of the ice bladder or the ice-cold cloth. Now and then, even in adults, we meet with an idiosyncratic incompatibility with cold. That has to be taken into account. Sometimes warm applications of either water or poultices prove more efficient in regard to the two indications, which consist in alleviating

irritation and reducing temperature. Sometimes a simple warm application, which may be changed every few hours, or a cold application which is permitted to get warm on the skin, will result in reducing both pain and temperature.

The subnitrate and the subcarbonate of bismuth, do not only cover and protect the mucous membrane, but have also a decided anti-fermentative effect. Thus it is surely indicated in irritated conditions of the mucous membrane; it seldom fails when given in sufficient doses. There is no harm in sometimes giving it in such doses that part of the introduced material will pass through the entire length of the intestinal tract without undergoing decomposition. As its taste is not disagreeable, it may be given together with tannin and opium; the daily dose ought not to be less than one drachm or a drachm and a half (4.0 to 6.0). At the same time the passages ought to be examined as to their reaction. Abundant acid, so frequently found in the slightest intestinal anomalies, requires the additional administration of alkalies. In most cases carbonate of lime is preferable to either magnesium or the carbonate or bicarbonate of sodium, the salts of both of which are apt to increase diarrhoea. Sometimes, particularly when the stomach can be relied upon, the salicylate of sodium may be added to the internal treatment. Beside the favorable effect of the sodium in the intestinal tract, the salicylic acid may prove beneficial both by its anti-

febrile and disinfectant action. I have long used it for that purpose, and recommended it as far back as 1877, in my article on dysentery in Gerhard's Handb. d. Kinderh. Vol. II, also in a paper on Infant Diarrhœa and Dysentery published in Amer. Jour. Obst., July 1879. Without knowing of my suggestion, Dr. Holt has lately praised the salicylate of sodium very highly for the same reasons, in his paper on the antiseptic treatment of the summer diseases of children. We shall always find it interesting to refer to the history of our science, both of theory and practice. Thus no trifling question of priority can be raised. Opium and its alkaloids are invaluable in the treatment of intestinal ulcerations. The objections to its use are decidedly exaggerated. Such accidents as have been reported in the journals as resulting from its administration must be attributed to the fact that either the dose was absolutely or relatively too large, compared with the idiosyncrasy of the patient. Dysentery both requires and tolerates larger doses of opium than an average diarrhœa, no matter whether the latter be the result of catarrh or ulceration of the small intestine or the cœcum or the upper part of the colon. In this respect dysentery stands abreast almost with peritonitis. The main indications are to relieve pain, reduce peristalsis, and diminish the copious serous secretion; no other remedy fulfils all of them so well. For this purpose it ought to be given internally; for enemata containing opium may act favorably, but the more in-

tense the tenesmus the greater the hyperæmia or the more extensive the ulceration, the less reliance can be placed on its effect, and the amount of the opiate thus brought into real action cannot be estimated. Amongst all the opiates I prefer a tincture, or the wine, or opium in substance, or Dover's powder; but rarely have I injected morphia under the skin. The effect of the drug is easily watched and controlled, by commencing with moderate doses, not repeating them too often, and being guided by the effect obtained. If opium is to be discarded, opium with hyoscyamus, or with belladonna, or hyoscyamus or belladonna alone, may take its place temporarily. Severe tenesmus may require the painting of the protruding part with Magendie's solution, or a solution of cocaine.

Astringents may either be given in combination with opium or separately. They are expected to pass wholly or partly through the entire length of the intestinal canal, thus coming into contact with the inflamed and ulcerous mucous membrane. Amongst those eligible are tannin, gallic acid, and vegetables containing the same (ratanhia, catechu), besides subacetate of lead, nitrate of silver, and pernitrate of iron.

The daily dose of tannin, when it is to be taken for a long time in succession, is from 10 to 15 grains, subacetate of lead 5 to 10 grains, nitrate of silver $\frac{1}{2}$ to 1 grain. The latter ought not to be given more than a month in succession, for fear of argyria, two

cases of which occurred in my own practice, and of my own making, many years ago. All of these medicines are best taken, if possible, in the form of pills. They appear to be better tolerated, and are certainly more effective.

The use of keratin, when it becomes handier and cheaper, will facilitate their efficiency to a considerable extent.

Another antiseptic which I have frequently administered internally in every description of intestinal ulcerations, in both acute and chronic form, is Naphthalin. As it is almost insoluble in the contents of the intestinal tract it is swept down and has an opportunity to act locally. It requires no keratin to cover it. I have used it to some advantage in intestinal tuberculosis; with considerable profit in acute typhoid poisoning and chronic typhoid ulcerations. Indeed, in many cases of typhoid fever I have ordered naphthalin from the start, and with good results, I believe. We have to expect a great deal from such topical medication, and it appears that it will be the great refuge in all infectious diseases whose principal localization is in the intestine, as for instance Asiatic cholera.

Adults will take from 15 to 75 grains daily, in powders, capsules or mucilage. Children bear, as a rule, according to their ages, from gr. ss, ii or iii, every 2 or 3 hours, in some mucilaginous substance. Some do not bear it well, but when such is the case, the stomach will give warning at once.

The local treatment of intestinal ulcerations requires the use of enemata. Their indications vary. They are to evacuate the bowels, or to reduce the irritability of the diseased intestine, or to accomplish an actual cure. These indications cannot be fulfilled separately; sometimes two, sometimes all three can be at the same time. The nature and quantity and the temperature of the liquid to be injected depend in part on the end aimed at, in part on the irritability of the individual intestine. Sometimes the bowel objects to the introduction of small amounts; sometimes, however, large quantities are tolerated very easily indeed. To introduce small amounts, the selection of the syringe is a matter of indifference, provided the liquid enters the bowel easily and without pain. To inject large quantities, however, undue pressure and local irritation must be avoided. Thus the fountain syringe alone will answer; it ought to hang but a trifle above the level of the anus, say from six to twenty inches. The temperature of the liquid is not always a matter of great importance. Some recommend the injections to be ice-cold, some, however, tepid; both are frequently recommended as panaceas. But the practitioner will soon ascertain that some bear and require the one, some the other, some indeed very hot ones.

In my experience, for the large majority of patients tepid injections answered best. Not seldom is the intestine in such a condition of irritation that even small

quantities of a very cold fluid are expelled at once. And again, there are cases in which enormous amounts of either cold or warm water are readily received. To accomplish the purpose of evacuating the bowel, plain water will often suffice, but three fourths of one-per-cent. solutions of salt in water will usually prove more acceptable. Additions of bitartrate of potassa, or castor oil, have proved so uncomfortable in my cases that I have discarded them long ago. However, when the secretion of mucus on the rectal and intestinal mucous membranes was very large, one or two-per-cent. solutions of bicarbonate of sodium answered very well indeed. For the purpose of clearing the intestines, either of feces or the morbid products, the single enema is insufficient. It ought to be repeated several times daily. When much mucus is secreted and tenesmus intense, it may be applied after every evacuation. In many cases the substitution of flaxseed tea or mucilage of gum acacia will prove advantageous. I have had to continue them for weeks for both their evacuating and alleviating effect. When, however, the latter effect alone is aimed at, that is, when tenesmus is to be relieved, small quantities will usually suffice. An ounce or two of thin mucilage, or starch-water, or flaxseed tea, with tincture of opium, or better, extract of opium, prove very comforting. Glycerin in water has been recommended for the same purpose. The former alone, or but slightly di-

luted, irritates, nay cauterizes. It will require close judgment and individual experience to ascertain the degree of dilution.

When a local curative effect is aimed at, injections of small quantities will be found deficient. As the local lesions are often extensive, the amount to be injected must be pretty large. Almost always astringents are required. Sulphate of zinc, or alumina, subacetate of lead, nitrate of silver, tannin, chlorate of potassium, ergotin, salicylic and carbolic acids, and creasote have been recommended. Of the more common astringents I prefer alumina or tannin in one-per-cent. solutions. Creasote answered well in solutions of one-half of a per cent. Salicylic acid resulted more frequently in pain than in benefit. Carbolic acid in solutions of one-half of a per cent. has proved very beneficial, but I have learned long ago to be very careful in regard to its administration when I observed a case of poisoning with that substance. A young man suffering from chronic dysentery was to be treated with injections of carbolic acid in a one-per-cent. solution. As it was expected that but a limited quantity would be tolerated before expulsion, no amount was specified. The intestine, however, being in a paralytic condition, received enormous quantities, until finally ten drachms (40.0) of crystallized carbolic acid disappeared in his bowels. That want of caution came near destroying the patient.

Injections of nitrate of silver may prove very use-

ful in cases not quite acute. Before the solutions of a quarter of one per cent., or of one, or two per cent. are injected, the intestine ought to be washed out with warm water without salt. After the injection has been made, it ought to be neutralized with a solution of chloride of sodium; it is still better to wash the anus and the portion of the rectum within easy reach with that solution before the medicinal injection be made. For even the mildest solutions are liable to give rise to intense tenesmus, when no such care has been taken.

When the ulcerations are but few, or in the lower portion of the bowels only, small quantities suffice. But extensive lesions require large injections, the patient being on his side, or in the knee-elbow position.* In a number of cases, both mild and severe, where neither the usual astringents nor nitrate of silver appeared to answer, I have been very successful when resorting to injections of subnitrate of bismuth. The drug is mixed with six or ten times its amount of water; of this mixture from one to three ounces (30.0–100.0) are injected into the bowel which has been washed out previously, twice or three times daily. The success was satisfactory, though a large portion of the injected mixture was soon expelled.

* In these cases the nozzle of the fountain syringe must be lengthened by attaching to it an elastic catheter, which is introduced as high up as possible, after the same plan that nutrient enemata are to be given.

This plan has also been recommended by a Western writer of note.

Suppositories containing the above substances may prove beneficial. But in order not to irritate they must be so soft as to melt readily. They may always contain some opium. But its admixture is not always sufficient to relieve the irritability of the rectum. For to accomplish this end, opium must at least begin to liquefy and to be absorbed, and absorption cannot be relied upon except where a part, at least, of the mucous surface is in a fair state of integrity. When no suppository can be tolerated, and the administration of an opiate to the intestine is indicated, the painting with Magendie's solution, or the injection of a small quantity of olive oil with tincture of opium may still be tried.

DIPHTHERITIC AND CROUPOUS ENTERITIS

It is rare, and occurs mostly in the lower portion of the small intestine. It is sometimes connected with general diphtheria, sometimes it ushers in an attack of it. It is more frequently connected with ulcerous catarrh. In these cases the exudation is deposited upon the mucous membrane rather than imbedded in it. The mucous membrane is red and thickened. The affection does not extend over a large surface. It is seen in the colon most frequently.

Even in such cases in which the diagnosis can be made with some degree of probability, the medicinal treatment yields but unsatisfactory results. Most antiseptics introduced into the stomach do not reach the seat of the disease. Animal charcoal, bismuth, and naphthalin are amongst those which are most promising.

TUBERCULOSIS OF THE INTESTINE AND MESENTERIC GLANDS.

Primary tuberculosis of both intestine and glands is certainly very rare. Such tubercular affections will occur with general tuberculosis, and then show themselves in the intestine in the form of nodules and ulcers. Such diarrhœa as occurs in the tuberculosis of adults, I have seen only a few times in children during my entire professional life. Still, it has been observed in the practice of others, and Biedert has made the diagnosis by discovering the bacillus tuberculosis in the evacuations. What formerly has been called tubercular disease of the mesenteric glands has been mostly simple inflammatory swelling terminating in hyperplasia and induration. This is the result of every irritation in the neighborhood, of every diarrhœa, and thus necessitates the speedy treatment and removal of every such cause. This enlargement may also be the result of infectious diseases, such as diphtheria, typhoid fever, and scarlet fever.

These glands which in consequence of neighboring irritation become acutely congested and inflamed, are red and succulent, the blood-vessels appear injected, and a rapid proliferation of cells takes place, not only in the glands, but in the surrounding connective tissue.

The newly formed cells may undergo fatty degeneration in a very short time, and be transformed

into pus. When this change takes place rapidly, not infrequently will pus be absorbed and enter the circulation and give rise to pyæmia, and also to miliary tuberculosis. Thus the result has been taken for the cause.

Another and more frequent change than this, is chronic transformation of the lymph bodies together with a proliferation of the lymph cells and the connective tissue. In fact, the latter will proliferate more than the former, and thus the lymph structure perishes in consequence of the pressure exerted by the newly formed, gradually increasing, and indurated connective tissue. The final result is that the lymph bodies are greatly enlarged, hard, and of a white, or grayish-white color on section.

Even this condition of things may lead to supuration in consequence of the degeneration of cells in the interior of those bodies as the result of the pressure of the external layers on the centre, or cheesy degeneration may take place.

In the majority of cases, however, no such change takes place, but the lymph bodies remain in their indurated condition, the lymph structure being destroyed and hyperplastic tissue remaining. The latter is useless for lymph circulation; in as much as it compresses the lymph vessels. Thus it is that the presence of such enlarged glands will act as an obstacle to the absorption of chyle. The result of this has been called athrepsia (Parrot), dystrophy, atrophy, marasmus, and consumption of the bowels.

It may terminate in extreme emaciation and incurable exhaustion. Anatomically, this is the same condition which shows itself in the lymph bodies about the neck.

The prevention of such a condition includes the successful treatment of the original cause, this being in most cases, a common diarrhœa. When the change has taken place and the hyperplastic induration is completed, the treatment is not very promising of success. As soon as the newly-formed cells have been transformed into fibres, the ability to effect their absorption grows less and less day by day, with the exception, perhaps, of those cases due to syphilis. Still it is advisable to try absorbents, particularly the iodide of potassium, which should be continued for a long time, and, according to age, in doses of from 5 to 15 grains daily in aromatic waters.

When all the acute symptoms have ceased, the iodide of potassium may be followed by, or combined with, the syrup of iodide of iron in doses of from 5 to 15 drops in sweetened water, three times a day.

The condition alluded to must not be mistaken for tumefaction of the mesenteric glands from other causes; thus, for instance, from primary lymphoma, or the glandular enlargement of leucocythæmia, or from sarcoma, which occurs primarily, or from carcinoma, which occurs secondarily in young and older children.

PERITYPHLITIS.

Etiology.—The vermiform process is relatively larger and longer in the newly born and child than in the adult. The colon of the newly born is only four times, whereas that of the adult is eight times as wide as the vermiform process. In the fourth year of life it is six centimeters long, in the seventh, seven, and in the adult it is only ten. This certainly yields predisposition to the entrance of foreign bodies into the process of children.

The foreign bodies which have been found in the vermiform process are the seeds of fruits and berries, the pits of cherries, shot, hair, hardened fæces, needles, stones, etc.

The cases in which a foreign body has been found in the vermiform process in very young infants, are only few, for it requires some predisposing cause for their admission. This predisposing cause is previous typhlitis or peritonitis, which results in adhesions, and greater patency with diminished elasticity on the part of the vermiform process. Very rarely is a post-mortem examination made after fatal typhlitis without exhibiting the signs of previous inflammation in the immediate neighborhood of the process. It is not necessary that there should have been a severe attack of peritonitis. Diarrhœa, intense constipation, dysentery, typhoid fever, are ample causes of a moderate local peritonitis. Thus it is that very young infants

are seldom the subjects of peri-typhlitis, because the preparation for its occurrence is mostly absent. Still, I know of the case of an idiotic boy who had been under the closest supervision all his fourteen months, and known never to have had any fruit or berry. He died of his first berry.

By the slow pressure of a foreign body in the vermiform process, a local gangrene or local peritonitis will set in which may result in exudation, in local suppuration and its capsulation, or in perforation.

The anatomical conditions found at post-mortem examinations are old or recent adhesions of the vermiform process, one or more perforations, the foreign body escaped or still in the aperture, abscesses in different places, sometimes in the immediate neighborhood of the process in its normal position, sometimes both being found upward and behind the colon, sometimes general suppurative peritonitis, and not infrequently, old cicatrices of different kinds and in different locations.

Symptoms.—The first attack is very sudden. There is sharp pain in the ileo-cæcal region, which remains in this neighborhood in most cases. But I have seen cases, two within the last year, in which there was but little pain in the ileo-cæcal region, but very severe pain in the middle of the transverse colon.

Vomiting is not infrequent, first of the contents of the stomach; finally fæces may be thrown up. In some cases the vomiting is only slight, in spite of general peritonitis.

An eight-year-old boy whom I saw on the 24th of September, 1880, had swallowed a cent two weeks previously, without bad consequences. On the 22nd he went to school feeling perfectly well, but was suddenly seized with pain at ten in the morning, was forbidden to leave the class, and had to remain until twelve o'clock. The pain was constant, and bent over, he succeeded in getting home and to bed, but not to get up again. The pain was in the right side of the abdomen where there was a localized swelling. The right thigh was drawn up; there was dullness on percussion over the swelling in the right hypochondrium.

On the 24th, when I saw him, he had vomited only twice, though peritonitis was general, and he did not vomit again.

On the 25th he sank rapidly. At the same time the temperature in the rectum fell to 97° F.

On the 26th, at the autopsy, there were found very strong adhesions between the coils of intestines themselves, and with the mesentery and abdominal wall. One pint of pus and many poppy seeds involved in hard faeces were found in an abscess about the vermiform process, in which there was one perforation, two gangrenous spots, besides an angular adhesion of the process to the colon, of very old date.

There is but little urine, and micturition becomes painful after a little while in consequence of the pericystitis (the peritonitis extending in the direction of the bladder).

The abdomen is tense and the distension becomes extreme. The thighs are drawn up, in many cases, but not invariably. About this time cautious percussion reveals dulness, which will increase. There will also be fever, which may reach 104° or 106° F. General peritonitis will set in, and henceforth the exudation cannot be recognized by percussion. Death may take place either by exhaustion or with the symptoms of perforation.

Additional symptoms which, sometimes, are very troublesome in the course of the disease, are peripheric pains along the right lower extremity.

The diagnosis is made from the sudden attack of pain, the fever, the circumscribed swelling, the result of percussion, and by secondary local or general peritonitis. That, in several cases, the pain may be most marked in the transverse colon, should be remembered.

The diagnosis from stercoraceous typhlitis is not always easy, but in children, constipation is not so frequent as it is in the adult, and the history of constipation should be known.

The termination of the disease may be by adhesions and cicatrization, or local formation of an abscess which becomes capsulated, perforation of the abscess into the peritoneal cavity, peritonitis without perforation, perforation into the intestine, with frequent recovery, or into a ureter or the bladder, temporary momentary improvement and the reappearance of the

abscess inside of the peritoneal cavity between the adherent intestines, perforation externally, the skin first becoming reddened and rupturing.

In these cases fistulous openings are frequent, and now and then anus praeternaturalis.

Exhaustion in the older cases is a common occurrence.

The course of the disease, when acute, is from three to eight days in children, more, however, in the adult. When chronic, and the abscess is capsulated the disease may run a long course.

Even with the greatest caution and care, relapses are frequent. Pain and fever will return, either in consequence of the presence of chronic peritonitis or the capsulated abscess. Now and then, in later years, intestinal obstruction may occur, caused by the chronic peritonitis, or the bending of the intestine on itself by the adhesions which have taken place.

Thus the prognosis in peri-typhlitis is always dubious. Still recoveries take place, and are not so uncommon as they have been presumed to be.

Treatment.—Absolute rest is required. The patient must use the bed-pan and urinal. Incipient peritonitis must not be disturbed. Recent adhesions are very apt to be torn and give rise to new attacks. An ice-bladder is to be applied at once to the right hypochondrium. Opium must be given freely. No purgatives, no injections. The injection, first of oil and afterwards moderate quantities of soap-water may, how-

ever, be indicated after a week or ten days. The food must be liquid, and given in small quantities at a time. The patient is expected to be in bed weeks after apparent recovery. If the child gets well, it must be kept very quiet, for an abscess may be capsulated and perforation may occur.

When the diagnosis is clear, there is no objection to an antiseptic puncture, which may be repeated a number of times for the purpose of ascertaining whether there be pus or not. For the very first symptoms noticed are very often those of perforation. When pus is formed, an incision must be made at once and the parts drained.

In chronic cases with a great deal of inflammatory exudation, the protracted use of iodide of potassium will yield good results.

After recovery, purgatives should not be given for a long time. But as a matter of precaution, warm enemata must be taken every day.

PARATYPHLITIS.

As there is a difference between peri- and parametritis, so there are cases of para-typhlitis to be distinguished from peri-typhlitis. In these cases, local inflammation, exudation, and suppuration, have nothing to do with the vermiform process. It consists in inflammation and suppuration in the copious connective tissue, between the pelvis and the colon, which at that place is not covered by peritoneum.

Such abscesses are the result of trauma sometimes; not infrequently of pelvic abscess; inflammation of the psoas; caries of the vertebræ; sometimes no cause can be found. They will develop rapidly and become very large. The abscesses are so large that sometimes pints or quarts of pus will either be discharged spontaneously or be removed by incision. But suppuration will not always result from this inflammatory process in the connective tissue.

A boy of twelve years, whom I saw with Dr. S., had undergone considerable exertion on March 14th, 1885, upon his roller-skates. On the 15th he complained of lassitude and fatigue. On the 16th, of trifling pain accompanied by a sensation of heaviness. On the 17th, of heaviness about the abdomen, pain while urinating, and he objected to studying. On that day he commenced to vomit. On the 19th he had a rectal temperature of 102° F. The pain was considerable in his right inguinal region. There was

hardness and dulness, and both increased, and meteorismus developed. The pain also increased in severity, but never to an extraordinary degree. There was no peritonitis, no suppuration, no intestinal disorder, but for recovery many weeks were required, and daily doses of from twenty to thirty grains of iodide of potassium.

INVAGINATION OR INTUSSUSCEPTION.

It consists in the slipping of a part of the intestine into the lower adjacent portion. Thus, a part of the colon may be invaginated into the colon; of small intestine into small intestine; or small intestine into large intestine, and particularly the ileo-cæcal valve into the colon and dragging the small intestine with it. Twenty-five per cent. of all the cases under observation occur under one year of age, fifty-three per cent. under ten years. Two thirds of those under a year are between the fourth and sixth month of age. Of eight cases, six occur in boys and two in girls. The youngest I have seen, occurred in a boy eight weeks old. Most of the babies affected have been known to old. Most of the babies affected have been known to be perfectly healthy. In few cases, constipation has been said to be a possible cause. It does not appear that it is caused by diarrhœa. Baginsky and Biedert deny the possibility of its occurring suddenly as the result of a blow, a fall, or a jump. But in one of my cases jumping while playing on the father's arm, was undoubtedly the cause.

A case published by Dr. Wohlfahrt, in one of the early volumes of the *American Journal of Obstetrics*, (1869) and which I also had an opportunity to observe, was caused directly by a severe spell of whooping-cough.

In babies of this age, seventy per cent. of the cases take their origin at the ileo-cæcal valve. This valve has

very strong circular fibres, and thus is apt to slip into the somewhat wider colon below. Besides, in this very region the intestine is loosely attached to a very flabby mesentery, and this part of the intestine is frequently filled with fæces; now and then it is the seat of a small tumor, the irritation and pressure of which will also favor the occurrence of invagination.

The invagination, inasmuch as one part of the intestine is enveloped by another, has naturally three layers; the external and middle layers touch each other by mucous membrane; the inner and middle layers by peritoneal covering.

The mesentery is drawn in with the intestine, and thereby the invaginated portion is turned and twisted, and the whole mass becomes more firm and irreducible. A large portion of the small intestine is, now and then, contained in the invagination, but that is the result only of its being dragged in mechanically. As a result of invagination, there are disturbances of circulation in the mesentery. These are œdema and hyperæmia of the intestine. There is consecutive peritonitis, particularly where the intestine is folded upon itself.

Sometimes, in consequence of stricture, gangrene occurs, and will be seen in different stages, and occasionally perforation originates in the serous membrane takes place.

Symptoms.—The healthy child is suddenly taken with colic, and screeching. There are one or two

movements from the bowels, with considerable straining, which may or may not contain fæces. At all events, *they contain mucus mixed with blood, or clear blood*. Sometimes a number of evacuations will follow each other and contain only blood. There is no fever. The child will look pale and collapsed after a very short time. The pulse will be very small, and the baby faint. At the same time the abdomen remains soft.

Vomiting commences very early; at first it is yellow and greenish, and after a while feculent. The children after having become accustomed to their suffering will appear to be better, in a certain number of cases, a condition which should not render the practitioner careless. For this apparent improvement is very temporary.

In a number of cases an oblong semi-elastic tumor is perceptible, mostly in the right side of the abdomen, corresponding with the location of the colon. This tumor may extend or change its situation, for in not a few cases, the invagination will increase to such an extent that it can be felt in the rectum, and, in some cases, will be so long as to pass through the sphincter. After one or two days peritonitis will develop with fever, and at that time the abdomen will become swollen to a greater or less degree. The tumor which may have been previously detected is no longer perceptible, and the baby may die of exhaustion or in an attack of convulsions.

The prognosis is doubtful in every case. Recovery may take place and be complete or only partial. The intestinal layers may adhere to each other, become gangrenous, and a portion of the intestine be thrown off. I have seen two such cases in children. Such a spontaneous recovery by elimination is said to take place in the first year in two per cent., from the second to the fifth in six, from the sixth to the tenth in thirty-eight per cent. of the cases, or gangrene may not occur but the surfaces of the intestine may remain adherent. In those cases the entire lumen of the intestine remains small. I have not seen such a case.

Relapses are frequent. Dusch has seen 22 relapses in one month in the same case. I have seldom seen them. Most of the cases which do get well, recover entirely. A long continuation of morbid symptoms, such as Baginsky speaks of, I have not seen in many cases.

The diagnosis of the cases is mostly made by the suddenness with which the symptoms appear, the sudden colic followed by faintness and collapse, the bloody passages followed by vomiting, the absence of fever and the presence of a tumor.

In volvulus, which means twisting of the intestine around its own axis, or around another intestine, or around a diverticulum, (treated of under the head of malformations) there is no blood, nor is there any blood in the case of obstruction by intra-intestinal or

extra-intestinal tumors, or by cicatrices, or by stercoraceous typhlitis.

Epstein and Crips report cases of *congenital* twisting of the intestine, from duodenum to colon, round itself. The infants lived several (5, 10) days. Also at birth, and at a later period, we meet with ligaments dating from fœtal or infant peritonitis, as the cause of twisting. Of the remnant of the omphalo—mesenteric duct, mention will be made in this connection.

In one case seen with Drs. Huber and Neufield, we excluded intussusception by the absence of bloody mucus or blood from the few movements the baby had. In that case, laparotomy being performed, we convinced ourselves that there was no invagination. The operation was unsuccessful, inasmuch as it had to be given up because of the condition of the baby, but we found that, in all probability, the obstruction was due to the fact that the right kidney was absent from its normal position, and was fastened in the right inguinal region. Very probably, though this observation could not be verified by post-mortem examination, the displacement of the kidney was in some way the cause of the obstruction.

Treatment.—The only successful treatment consists in reposition of the intestine. When it is successful, there is immediate relief. The anxious expression and collapsed condition improve instantly, the patient will go to sleep, and soon eat. In the beginning of my practice I used large stomach sounds

for the purpose of reducing the invaginated mass, but I have almost invariably found the case to be worse afterwards, because the sound will crowd the parts upon each other. I have also used air blown into the intestine by means of bellows through a long tube, and in order to make the supply more regular, I availed myself, twenty-five or thirty years ago, of an apparatus for the production of carbonic acid gas. After that time, when the siphons containing carbonic acid and mineral waters were invented, I used them for the purpose of filling the intestine more or less slowly with both gas and water. All these measures have proved successful in occasional cases. What has done me better service, however, is the following simple plan. The baby is turned on its belly, the hips are raised, the abdomen gently supported by a soft pillow. The mouth and nose being the lowest part of the body, they must be protected.

The baby is then anæsthetized with chloroform, and warm water is poured into the rectum with but little pressure. The injection is frequently intermitted, while the anus is closed by the finger. At the same time the abdomen, in the direction from below upwards, is gently kneaded and its contents moved about.

In not a few cases have I seen immediate result from this treatment, in the course of the last twenty years. When reduction has been completed, the baby must be kept absolutely quiet, take opium, now and

then a rectal injection of chloral in solution, and wear an abdominal bandage just tight enough to steady the bowels.

In adults, Kussmaul reports favorable results from washing out the stomach. When the simple measure which I propose is unsuccessful, after a number of trials, laparotomy ought to be performed. The successful cases of laparotomy are not very numerous, but sufficiently so to justify the operation as the only means that promises a favorable result in irreducible cases. Henry B. Sands, of New York, has saved a baby of six months by this operation, and there are other similar cases on record. It is necessary to operate in time, and not delay too long; for, at the best, laparotomy, in these cases, has its unusual difficulties.

At an early period all the tissues involved are hyperæmic and soft, with a tendency towards gangrene. In a child of eight weeks, on whom I operated, it took me ten minutes to separate the parts from each other, although I had the invagination, measuring six or seven inches, outside of the abdominal cavity. This delay was due to the softness of the tissues, the close impaction of the three layers, and a large amount of mesentery in the mass. Besides, the field of operation is very small and the difficulty of returning the intestine into the abdominal cavity very great indeed.

PARASITES, WORMS, WORM DISEASE, HEL- MINTHIASIS.*

The intestinal parasites found in children belong to two classes, the nematodes and cestodes.

1. *Nematodes*. *Trichinae* behave in the child as they do in the adult. They are found in the upper part of the small intestine. They are usually matured two and a half days after the diseased meat has been eaten, the young worm makes its appearance five days afterwards, and then begins to emigrate into the muscles. This process may last from four to five weeks. The female is from three to four millimetres in length, and is recognizable by the breed inside. The male measures only one and one-half millimetre.

Ascaris lumbricoides has a shape very much like the common earth worm, pointed anteriorly, flat and rolled upon itself posteriorly, with three lips anteriorly, and yellow-brownish ova with a double shell. It is mostly found in the middle part of the small intestine, not infrequently in the duodenum, and likes to emigrate to the stomach and is then expelled. The female is from 25 to 40 cm. long and 5 mm. thick, the male 15 to 25 cm. and 3 mm.

Oxyuris vermicularis (pin worm.—The male is not over one-half centimetre (one-fifth of an inch) in length, and is rounded behind. The female meas-

* Johannes Orth Text-book of special path. anat., 1887.

ures one centimetre, is pointed, and much more numerous. The ova are very small, not over $\frac{1}{50}$ th of a millimetre in length, some only $\frac{1}{100}$ th, oval, more arched on one side. The shell is composed of three layers and very thin. It lives in the whole intestine, the male and young mostly in the small intestine, the pregnant female in the coecum; for the purpose of depositing its eggs it descends to the rectum. In the ovum the embryo is often in full development.

2. *Cestodes. Taenia solium* (pork tape-worm). When of full length it measures from two to three metres (six to ten feet). It develops from the cysticercus of the pig. The head is the size of the head of a pin. It carries four suckers laterally, each with a crown of hooks, and the rostellum, a protuberance which in old specimens is of a black color. The neck is an inch in length, very thin, so that its articulation can be recognized by the microscope only. The several apertures are located laterally on the right and left alternately. The uterus has from seven to ten lateral branches, around which there are often dropsical enlargements. The proglottides behind the neck are broader than they are long, a meter behind this part they are square, and below that longer than they are broad. The ovum is spherical, about $\frac{1}{300}$ th of a millimeter in size, with a thick membrane, and with one or more radiated stripes.

Tenia mediocanellata (Beef tape-worm).—It grows from the cysticercus of beef and is therefore the tape-

worm of small children by preference. Its full length is four metres (twelve to thirteen feet). The head is of heavier build, and has four suckers, but no rostellum and crown of hooks. In old specimens it is black. Below the head the articulation of the neck is visible to the naked eye; the proglottides are thicker and heavier, the mature ones longer than they are broad. The sexual organs resemble those of *tænia solium*, only the uterus has about twenty-five lateral branches with simpler structure and subdivisions; the ova are like those of *tænia solium*, but thicker and more oval.

Bothryocephalus latus (Broad tape-worm).—It is the result of cysticercus of fish and therefore mostly seen on the shores of sea and lake. Its full length is from five to eight metres. The head is rather long and flattened laterally, with two suckers on the thin side; uterus small and less distinct; the sexual organs on one side. Sometimes they appear fenestrated, in consequence of the bursting of the sexual apertures. Thus a genuine fissure may occur, which yields the impression of a double development. The ova are oval, $\frac{1}{750}$ th of a millimeter long, $\frac{1}{500}$ th of a millimeter broad, with amorphous contents and a brown shell exhibiting something like a cover on one of its sides.

The symptoms accompanying one or numerous worms in the intestinal tract vary in number and nature. All of them can be referred to other diseases, thus it was that worms were once (still ?), next to colds and dentition, the great etiological bugbears.

It follows that the diagnosis of worms—helminthiasis—ought not to be made unless either worms, or parts of them, or their eggs have been found—macroscopically or microscopically—in the movements. To conclude that there must be worms “dissolved” when the evacuations are replete with mucus and ununderstood material, is fortunately the mistake of bygone times only.

Those symptoms belong either to the abdominal organs, or by reflex, to distant ones, and then they are of neuropathic nature. There is, or may be, pain, of intermittent character, often improved by milk and fatty food, increased by salty, aromatic and acid substances (fruit). Appetite normal, diminished, or increased. Stools costive, loose, sometimes mucous, and may contain eggs or worms. Vomiting may occur though there be no ascaris or oxyuris in the stomach. Vogel reports the case of a baby of nine months, who, after having been fed on farinaceous food for three months, brought up an ascaris by vomiting. Sometimes the children look pale, apathetic, and swelled over face and lips. This tumefied—œdematous—appearance *and* the helminthiasis are probably the coordinate results of coarse farinaceous feeding. There is the pruritus of, and boring in, the nares, common to many digestive and respiratory diseases. In some cases the pupil is certainly dilated. There are mild or severe nervous symptoms besides. Restlessness, sleeplessness, choreic movements, epilepsy

(rare). Vogel saw a child dying with what appeared to be hydrocephalus. At the autopsy there was none, but there were one hundred ascarides which obstructed and reddened the intestine.

The pruritus and local irritation may be, according to Biedert, more than mechanical, they may be chemical. He quotes Huber, who, after having examined a number of ascarides an hour, experienced beside the pungent odor, pruritus of the hands, local urticaria, and conjunctivitis.

Oxyuris is apt to emigrate to the perineum, vagina, and prepuce. It will give rise to irritation (frequent scratching), catarrh and masturbation.

Ascarides will pass spontaneously when the intestinal tract is in a morbid condition. A worm wants healthy surroundings, and the morbid change of the intestine is, as a rule, not the result of the presence of the worm; on the contrary, the latter makes its voluntary exit when it begins to loathe its quarters. Europeans do the same when they emigrate to America. But they (the worms) will also emigrate to the stomach, œsophagus, nose, larynx, vermiform process, pancreatic duct, and choledoch duct. Liver abscesses have been found (Davaine, Scheuthauer) containing putrid ascaris or its egg. Ascaris has made its appearance through the umbilicus, either through an open diverticulum of Meckel, or through the ulceration of an adhering intestine. It has been found in the abdominal cavity; and to give rise to

fatal peritonitis. The perforation of the intestine through which the worm escaped, may have existed, and the worm availed itself of the proffered opportunity. Or it may have forced its own gate open. Such authorities as Siebold and Leuckart are of the opinion that the small lips of the ascarides are hard and sharp enough for that purpose.

Tape worm is apt to give rise to colic, vomiting, loss of, or craving appetite, diarrhoea, hiccough, and nerve disorders of many kinds, but the diagnosis cannot be made except when proglottides have made their appearance.

Treatment.—The medicines available for dislodging worms are all irritant. They must not be given unless the diagnosis has been made positive. It is better that the diagnosis of a gastritis, enteritis, or meningitis should be made by the medical man, than that the child should be punished for his carelessness. Before taking anything to expel tænia, a child ought to be in fair general condition. Moreover, its own tænia, the mediocanellata, is the most difficult to expel. The best time is when proglottides are seen in the movements. Moderate abstinence, and a purgative (castor oil) ought to precede the administration of drugs. It must be expelled, for though the symptoms may not be urgent, some day there will come either local and reflected ones, or a possible invasion of cysticercus into some vital (brain) or important organ (liver, spleen, lung, ovary).

Spontaneous emigration will be noticed occasionally, but it is rare and not to be expected. After the successful termination of the cure the intestine must be allowed rest. The plainest diet, such as milk, and strained farinacea, and peptones, are indicated for days.

I have administered a great deal of kamala, sometimes 10-15 grammes ($1\frac{1}{2}$ —1 ounce), during one hour, early in the morning; the breakfast (milk) to be postponed for two hours. The effect was not uniform, and often negative. It was improved by giving a dose of 25 centigrammes to $\frac{1}{2}$ gramme (4—8 grains) 4 or 5 times daily, for ten days or more, previous to the larger dose. A few hours after the larger dose castor oil ought to be given.

Kousso, 4 to 15 grammes within two hours, after the required preparation, to a child of from 2 to 10 years.

Extract of filix mas has proved most successful in my hands. A small child may take 1 gramme (15 grains) in an aromatic mixture within one early morning hour. A drachm is tolerated and required by a child of seven or eight years.

Pelletierin tannate is given in doses of 1 or 3 decigrammes (0.1—0.3=grs. iss. to v.). I have but little experience with it. It is obtained from cortex punice granatum, which was (and is still) given as a decoction, but is too disagreeable and sometimes dangerous a mess for a child or infant.

For the removal of ascaris the general preliminary treatment ought to take place; at least, the bowels ought to be moved gently. The powdered sem. cinæ, or flor. cinæ, 1 gramme or more, mixed with a syrup, and followed by castor oil, will work well. Santonin, which is obtained from it, works as well and more pleasantly. From 1 to 3 centigrammes (gr. $\frac{1}{6}$ — $\frac{1}{2}$ —i.) several times a day, with a purgative such as magnesia, calomel, or jalap. The latter addition is desirable, inasmuch as now and then poisonous symptoms may appear. Older children will complain of "xanthopsia," yellow vision. Urine and conjunctiva are yellow, sometimes.

As oxyuris vermicularis is frequently found in the rectum, or its neighborhood, the internal administration of drugs is not indicated. The external results, such as vaginal catarrh, must be treated locally. The worm is removed by a small piece of blue ointment introduced into the rectum, or rectal injections of vinegar and water (1:3-4), corrosive sublimate (1: 1500-6000), of decoctions of onions or garlick. It is difficult to dislodge as it also inhabits the colon and even the small intestine.

There is another parasite, the *anchylostoma duodenale*, which for some years has attracted a great deal of attention.

The male is from 6 to 10, the female from 10 to 18 mm. in length ($\frac{1}{3}$ — $\frac{1}{2}$ inch). The mouth is bell-shaped, there are two dental prominences above, and

four below. Particularly the female is thus characteristically endowed, so that it sucks and bites at the same time. Eggs are found in the feces. They are smaller than those of ascaris. It was found in large numbers amongst the Italian workmen of the St. Gotthard tunnel, the tile laborers of the Rhenish provinces, and the Hungarian miners and their children. The cause of its presence is looked for in the muddy water they drink, which is filled with the ova, and the clay they work in, which contains the larvæ. The general symptoms are very severe and dangerous. Debility, paleness, utter exhaustion as in pernicious anæmia, relative diminution of red blood cells. This "Egyptian chlorosis" was explained by Griesinger, by the presence of anchylostoma, as early as 1854. Besides, there is pain in the epigastrium, constipation, mucous and bloody discharges, sometimes real hemorrhages and dyspnœa.

Treatment. — Anchylostoma duodenale requires santonin, thymol (adults took 2 to 10 grammes daily), and principally extract. filicis maris æthereum.

INTESTINAL MALFORMATIONS.

The intestine of children is normally longer than that of adults. Up to the ninth, even to the twelfth year, the capacity also is greater than that of the intestine in the adult.

An abnormal length of parts of the intestine may occur anywhere, but particularly in those parts which are attached to the mesentery.

There is a malformation that has been called partial duplication, or reduplication. It is in fact not this, but a diverticulum, so-called by Meckel. This is met with sometimes in the newly-born, twenty or thirty centimeters above the ileo-cæcal valve; in the adult one meter, sometimes a little higher or a little lower; occasionally even in the colon, where its aperture is quite large. It extends from two to ten centimeters, or more, in the direction of the umbilicus, to which, now and then, it is attached by a filament. This diverticulum is nothing else but the remnant of the original omphalo-mesenteric duct. Sometimes the whole diverticulum is attached, inside, to the umbilicus, making a cul-de-sac or cloaca. Sometimes the cul-de-sac penetrates the umbilical ring, or it is attached to the peritoneum below the umbilicus, or it terminates in the umbilical ring with a fistulous opening, or it adheres somewhere to the abdominal wall. Sometimes the adhesion to the abdominal wall is only partial, and then meconium will enter the abdominal cavity. This

is found mostly on the side not covered by mesentery. In rare cases it is separated from the intestine, and then it is apt to form a cystic tumor. Now and then there is necrotic destruction of the umbilicus, with pyæmia, or septicæmia, or a fistula resulting therefrom. Now and then the diverticulum gives rise to twisting of the intestine at any time during later life. Not every cystic tumor found in the abdominal cavity, however, in or near the intestine, is of the same character. Some of them belong to the class of teratoma (*fœtus in fœtu*).

Very small cystic tumors have been found in the colon, soon after birth. Most of them appeared to have been developed after dysenteric processes, and to be the results of local extravasations. Some may originate in exudation; some, however, are retention cysts belonging to the class of those which grow out of swelled glands with obstructed ducts, and follow a chronic inflammatory process in the mucous membrane of the large intestine. The localization of the dysenteric process in the lowest part of the intestines explains why such cysts are absent from the small intestines. The only case in that neighborhood, in the newly born, I know of, has been reported by Dr. Eugene Frankel, of Hamburg, in *Virchow's Arch.*, Vol. 87, 1882, p. 281. It gave rise to very serious symptoms of complete obstruction, and terminated fatally. The specimen dates from 1851, and was taken from a female child after she had died, on the

eleventh day. When she was born, and during two days, she ate and defecated normally. Then vomiting set in. The obstruction was complete, food and feculent matter were thrown up. Drastic purgatives resulted in evacuations and subsequent diarrhœa, requiring constipating administrations. Two days afterwards again constipation, drastics again, and no effect. At the autopsy the large intestines were found empty, the small intestines inflated with gas; at the lower end of the ileum there was a spherical cystic tumor between mucous and serous membranes of a diameter of $2\frac{1}{2}$ Cm. (1 inch), obstructing the lumen of the intestine almost completely, even in the dead body.

A very important malformation of the intestinal canal is partial or complete obstruction, stenosis or atresia. Besides the atresia which can be produced by cystic tumors, as described above, there is, now and then, a duplication of the mucous membrane, which is apt to produce obstruction like the hymen in front of the vagina, and close the entrance to the cavity either partially or completely. Sometimes the obstruction is so complete, that nothing is left of the intestine except a filament. Then there is also absence of the corresponding part of the mesentery. This condition has been observed in a few cases, particularly in the duodenum, mostly about the entrance into the ductus communis choledochus, and also in the ileum. It has been regarded as the result, either of fœtal peritonitis, or of the twisting of the intestine in an early

embryonic or foetal period, but it is the result, particularly in the rectum, of actual arrest of development.

I published a rare case of this kind in the *American Medical Monthly*, 1861. It was that of a male infant 39 hours old.

The history of the case was given by the attendants in the following manner: The child had no evacuation of the bowels for the first twelve hours after birth. A medical man was called in, who removed some obstruction by means of his fingers from the anus, and gave an injection, whereon a string-like, hard, solid, whitish mass was removed through the anus. The child then was declared to be all right, and he left. Nevertheless, no regular passage was had, but the patient evacuated a mass like that described, but less in quantity, several times. He commenced vomiting, however, bringing up a black substance, which was afterwards changed into a brownish or yellowish-gray mass by the addition of milk, which the child would readily take from the breast. When the infant was presented he still looked well-developed; no deformity was perceptible on any part of the body. Exhaustion began to show itself, from the somewhat collapsed face and the sunken fontanelle. Abdomen not much inflated; only across it, below the liver, and a little downward to the left, an intestine was both seen and felt. It was inflated with gas, which appeared to be unable to escape. The rectum was very narrow, but could be explored to the length

of the fifth finger, and no perfect impermeability found. The fæces removed last were pretty greenish, solid, about a fifth of an inch in diameter, and completely formed. Having no other means of diagnosis ready, the case was declared to be one of stricture of the intestine, somewhere between the colon transversum and rectum. The last evacuation, however, was subjected to a microscopical examination, and found to contain a uniform mass of cells, of average size, with nuclei and some nucleoli. No fat, nor hair, nor cholesterine, nor large epithelial scales; thus the evacuation was set down as intestinal mucus only; not as meconium. On the next day the substance thrown up from the stomach was submitted to a microscopical examination, and found to contain, besides milk, some crystals of cholesterine and a large number of large epithelial scales. The case was then put down as one of complete impermeability of the intestine, as there were constituents of meconium above, but not below, a certain point.

Patient died with the symptoms of exhaustion, when seventy-two hours old. Post-mortem examination was made nine hours after death, but abdominal cavity only opened. Rectum very narrow, as described above. Above, the colon appeared only about a fifth of an inch in diameter, but could be inflated up to the vermiform process; no air would pass the valve. A tube was then introduced through a small incision above the ileo-cæcal valve, and infla-

tion attempted from above downward; but no air would pass the valve, thus showing a perfect impermeability. The whole colon and rectum have a length of about fifteen inches. Stomach is normal; perhaps a little larger than usual. Duodenum and upper part of the intestine, to a length of about fourteen inches, are very much dilated, and terminate in a very large *cul-de-sac*; no opening being found into the remaining part of the intestine, which all of a sudden become of a decidedly diminutive size, of perhaps a fifth of an inch in diameter. This is the size of the intestine all through its length down to the valve, with the following exceptions. As stated, there is no connection whatever between the dilated upper portion of the intestinal canal and the suddenly contracted part, both of them ending in a *cul-de-sac*. Below this, about two inches from this first impermeability, the contracted intestine again ends in a *cul-de-sac*, after which, to a distance of eight lines, no intestinal cylinder whatever is found, the mesentery hanging free in the abdominal cavity. Then, again, a small intestinal cylinder, of nine or ten lines in length, is found closed on either end. Again, the mesentery without its intestinal appendix for about eight or nine lines. Again, an intestinal cylinder of the same length. Again, absence of intestine for a similar distance. A third intestinal cylinder of the same length, closed on either end, follows this; and again, at last, free mesentery for about half an inch. Then, finally, the intestine

fairly begins again, uninterrupted in its lumen, and unchanged as to its diameter of about a fifth of an inch, and measures, down to the ileo-cæcal valve, twenty-two inches. Thus, the whole length of the intestine, including, altogether, two inches of mesentery not accompanied with intestine, is about four feet and a half, exhibiting in its course, besides the dilatation of the upper portion, a nearly equal coarctation of the lumen, the colon being a little larger than the rest, and the rectum not so narrow as the colon itself, two perfect impermeabilities; and beyond these four total interruptions of the course of the intestinal canal, the free intervals being, in the average, eight or nine lines in length.

Liver, spleen, kidneys, and bladder perfectly normal. Both of the kidneys contain beautiful specimens of the so-called uric infarcts.

Cases like the above are more than merely rare. Perhaps there is, beside an important case in Ammon's Atlas, and Küttner's, and Hüttenbrenner's cases, not more than half a dozen on record. In Küttner's case the jejunum ended in a *cul-de-sac*; then there was a piece of intestine, of three inches in length, ending in a *cul-de-sac* on either side; further, a second of the same description; finally, a third one, five inches long. Then, at last, the colon, commencing with a *cul-de-sac* above, and ending in a normal anus.

A similar case was one I saw with Dr. Henry Schweig, nearly thirty years ago. With similar ana-

tomical changes, constant vomiting soon after swallowing food, the baby lived thirty-five days. Some of these patients exhibit a remarkable vitality indeed. A case kindly sent by Dr. Huntington, of New Rochelle, to my college clinic, more than ten years ago, was heard of when thirty-three days old. How long it survived afterwards, I have not learned.

As already stated, most of the changes occurring in the rectum are due to arrest of development. The posterior end of the alimentary canal forms, about the fourth week of foetal life, a cloaca with the allantois. In its anterior end are the sexual ducts. The anterior part of the cloaca is open; the posterior end, corresponding with a later formation of the intestine, is closed. The two parts are soon separated, by the canal being bent in at its posterior end, into the urino-genital sinus and the rectum. The first partial septum is the primary perineum. It grows gradually, and then separates the opening of the anus and the sexual organs.

Malformations of the rectum may be of different kinds.

First, the anus is present; atresia of the rectum is far inside. It may have been the result of twisting, and then two *cul-de-sacs* of the intestine may be found in different positions towards each other.

Second, there is no anus. The rectum opens by a thin fistula in the perineum; or in the raphe of the scrotum; or in the vulva. Evidently, in embryonic

life the septum was formed too near what was later the sexual opening.

Third, there is no anus. The rectum terminates in a fistula attached to the mucous membrane of the urino-genital organs. In these cases everything was normal except the original perineal septum, and the part of the intestine which should have developed from the cloaca missed its development. There are, sometimes, other malformations connected with this anomaly.

Fourth, there is no anus. Sometimes it is indicated by a dimple. The intestine terminates in the neighborhood of the promontory. Between the perineum and the intestine there is absolutely no remnant, with the exception of a few cases in which a residual filament has been found.

In these cases it is possible to assume different causes.

First.—Inflammation and conglutination.

Second.—Arrest of development, perhaps connected with an excessive absorption of the *pars caudalis* of the spine.

Third.—The primary perineum may have developed posteriorly to an abnormal degree, thus separating the intestine above from the remnant of the posterior part of the cloaca, which was to become the anus.

Fourth.—There may have been developed a diaphragm, hymen-like, from the part of the mucous

membrane, as alluded to when the upper part of the intestinal tract was under consideration.

When the original embryonic abdominal fissure remains patent, the newly-born may have an ileum or colon which is also open.

The vermiform appendix may be absent, or nearly so.

The small intestine, also the large, may be too short, and the difference between the two may be but very small.

There may be *anomalies of position*. The intestine may protrude through the abdominal fissure; through a fissure in the diaphragm in its left half; through the natural openings, the inguinal and femoral rings, and others.

Transposition of the intestine may occur independently or in connection with other transpositions. This anomaly is the result of the fact that the intestine has to go through a series of changes of location before it assumes its natural shape.

The colon ascendens or. transverse may be entirely absent.

There are not infrequently small, tumor-like bodies in the walls of the small intestine. Sometimes they have been found at the apex of diverticula. They are the result of a few pancreatic cells separating from the main body at a very early period of embryonic life.

The symptoms of imperforate rectum and atre-

sia ani are as follows : No evacuation, no anus, or the exploring finger gets into a *cul-de-sac* half an inch or an inch above the anus. Sometimes, however, the obstacle is very far above the finger's length. The colon begins to distend, now and then with dulness on percussion. At first the swelling may show itself in the hypochondrium first and extend to the right inguinal region along the lengthened sigmoid flexure. Vomiting at first yellow, afterwards of meconium. Inflation, not always uniform, of the whole abdomen, pain, dilatation of the external veins, superficial thoracic respiration, elevation of temperature and other symptoms of peritonitis.

Treatment: In view of the fact that the imperforate condition may but be apparent, injections ought to be tried often and copiously. If unsuccessful, they ought to be followed by the operation, performed for the purpose of either joining the two unconnected *cul-de-sacs* or drawing the rectum downwards, or if that be impossible, of establishing an artificial anus in the (right or) left side.

HERNIA.

Umbilical Hernia.—It is found in two forms: first, *congenital*; second, *acquired*.

Congenital umbilical hernia, also called ex-omphalus, or congenital ompholacele, is the result of a genuine arrest of development of the abdominal wall. The embryonic fissure of the abdominal wall, which should have closed about the seventh week of embryonic life, remains open. There is found in it a large part of what is to become the intestinal tract, and the abdominal wall is not closed; thus the tract remains outside and is covered by peritoneum only. When the fissure is very large, the liver and a portion of the stomach will also protrude. If so, the case becomes more favorable after the child is born. That is when the large liver is included in the protruding parts, the neck of the hernia remains large, and it may be reducible. When, however, the intestine alone is enclosed in the hernia, the neck of the sac will contract, and there is no possibility afterwards of reducing it.

In the sixth volume of Gerhardt's *Handb. d. Kinderk.*, Kocher reports twenty-four cures of congenital ompholacele, by means of reposition, and in the *Vienna Med. Monthly*, 1887, page 1145, C. Brenz reports the case of a girl, who weighed 2,700 grammes and was born with an umbilical hernia. Reduction without opening the hernial sac, he found to be very

difficult, but after it had been accomplished, he compressed the sac by means of a pair of pincers, removed the sac with scissors, applied three percutaneous ligatures below the clamp, removed the clamp, applied the Paquelin cautery to the stump, and covered it with antiseptic dressings. He removed the dressings and the ligatures on the eighth day. The hernial sac contained amnion and peritoneum. The case proved successful, although there was peritonitis as early as twenty hours after birth.

A rare case of the kind has been reported by Dr. E. H. Martin in the *Med. Record* of Sept. 24th, 1887. It is moreover complicated with either a complete absence or complete fissure of the sternum (like the celebrated Groux case.) "There is a deficiency in the abdominal wall, the recti abdominis being separated or non-developed and there is an umbilical hernia, which, in acts of straining, protrudes as large as the clinched fist. The convolutions of the small intestine can be readily seen through this thin covering. The child is still living at this writing (four and a half months), and has developed an inguinal hernia of the right side. Weight about same as at sight."

A predisposition to acquired umbilical hernia is produced by the large size of the cord and navel, by leanness and feeble development of the child, by a great deal of colic, screaming, coughing, straining in consequence of diarrhœa or constipation, phimosis or anal fissure.

The hernia contains small intestine and peritoneum. It develops gradually until it may reach the shape and size of a pear, or even become larger. It shows a uniform surface with the exception of a small spot, usually on its inferior and lateral portion, which is the remnant of the cicatrized umbilical blood-vessels.

Incarceration takes place very rarely, still Treves and others have reported successful operations for such in accidents. As there is a predisposition to the development of this variety of hernia, so there is a tendency towards spontaneous recovery. The round umbilical aperture will normally change after a number of months, or even a year, into a narrow fissure, more fat will develop, the muscles will become stronger, and then the intestine will be retained within the abdominal cavity.

It is desirable to retain the contents of the hernial sac inside the abdomen. For this purpose, trusses are very unavailing. Strips of adhesive plaster will serve very much better, but in most cases they are objectionable because they irritate the sensitive skin of the baby.

Whatever application is made to the hernia directly must be larger than the aperture. It should not be too hard. Linen compresses, and compresses of woven lint, plates of cork covered with linen or lint, may be applied and held in position by means of a bandage. Knitted bandages will suit better than the ordinary bandage of linen, cotton, or flannel.

Inguinal Hernia.—This is mostly external and congenital, but is seldom seen immediately after birth. The processus vaginalis peritonei remains open, beyond its normal time. Thus the intestine will slip into the scrotum, and down to the free surface of the testicle. In the female the inguinal canal (canalis ligamenti rotundi) which is to receive the round ligament, allows the intestine, in very rare cases the ovary also, to slip in.

The hernia shows itself as a soft mass, spherical, appearing in and in front of the inguinal ring, and gradually descends. It is very apt to be reduced spontaneously, and just as apt to reappear. The testicle is always found (above and) behind it. The hernia will gradually increase in size, and sometimes is surrounded by liquid which descends with it. This complication of hernia and hydrocele in the young infant, is very rare. Sometimes the hernia will adhere to the testicle, and then become irreducible.

The predisposition to the formation of this variety of hernia is produced by the shortness and straightness of the inguinal canal in the fœtus and the newborn, also by the fact that the testicle descends sometimes too late or has not descended at all at birth.

Particularly, is it the right testicle which is liable to descend late, and the infantile inguinal hernia is mostly seen upon the right side.

Its proximate causes are straining in screaming, cough, constipation, phimosis, and fissure of the anus.

The diagnosis is made by the gurgling sound in the protruding mass, by its opaqueness, and its tympanic percussion note, and, as a rule, by its easy reduction.

Its diagnosis from hydrocele of the spermatic cord, is made by the fact that the latter is a more or less immovable body, seldom extending to near the inguinal ring, and never into it, and is not known or liable to increase in size suddenly.

In most cases the hernia is easily reduced. There are, however, quite a number on record in which incarceration and strangulation rendered operative interference necessary. The operation should not be delayed, after it has been demonstrated that reduction was impossible while the patient was under the influence of an anæsthetic.

In one case Rees succeeded in reducing a hernia after aspirating the intestine and removing a quantity of turbid liquid. It is certain, however, that this practice should not be recommended for general adoption.

Inguinal hernia in the newly born is apt to recover spontaneously. When the short straight inguinal canal becomes longer and more oblique, in the course of a few years, and the amount of fat increases, it may disappear, but these predisposing factors have never succeeded in effecting a cure by themselves.

I have seen a great many cured, but only when

the hernia was retained inside of the abdominal cavity completely and constantly. These babies must wear a truss for several years. It must not be removed except when they are sleeping quietly. Trusses are uncomfortable in the beginning, they may give rise to cutaneous irritation, and so much the more is it necessary to keep the truss clean, and to select one which while it does not press too hard, will not prove too feeble.

Femoral hernia.—This is exceedingly rare. I have seen but few cases. St. Germain reports a case of incarcerated femoral hernia, in a girl eleven years of age, on which he operated successfully.

Median abdominal hernia.—This occurs in the linea alba, and is the result of small holes remaining from the embryonic abdominal fissure.

Lateral abdominal hernia, I have not seen in children. In the adult they are not only the result of trauma, but also of an overstrain of the edge of the muscles, generally the rectus.

Ischiadic hernia is mostly found at the edge of the pyriform muscle. It takes a layer of fascia along, and is found with the superior gluteal artery, which lies behind the hernia, between the ligamentum tuberoso-sacrum and spinoso-sacrum.

The ischiadic artery and nerve are found posteriorly and below, and are separated from the hernia by the pyriform muscle.

There is no treatment for this variety except to give it protection.

It is found in the line between the trochanter major and the symphysis sacro-iliaca, and is covered by the gluteus maximus muscle. In most cases it is congenital. I have seen two in both of which the hernial tumor hung suspended from the nates. It has been mistaken for cyst, and for fœtus in fœtu.

Most of the herniæ which are found in the adult are not preformed congenitally. This is so with regard to the external herniæ. The internal herniæ are always preformed in the fœtus.

Perineal hernia has lately been the subject of a thorough essay by L. Ebner, in D. Zeitsch. f. Chir., vol. xxvi, Aug. 5, 1887. He arrives at the following conclusions: Perineal hernia has a congenital predisposition, and is never of traumatic origin. The cavity between rectum and bladder (or uterus) is deeper and more marked in the embryo than in later life; this feature of the cavity persisting, gives rise to the predisposition mentioned above. The size and depth of that cavity is not equal in all embryos. The hernial contents descend in the upper part of the median line, in the lower part only a deviation takes place to either the right or left. Perineal hernia protrudes through either of two fissures, one of which is between the levator and ischiococcygeus, the other between the ischiococcygeus and coccygeus muscles. These fissures can be demonstrated in the human

perineum quite frequently. All the herniæ occurring about the lower pelvic apperture are but varieties of the same class. The perineal herniæ of the dog are protrusions of the rectum—without any hernial sac—through the large fissures in the levator ani. The same occurrence is observed in man, and results, as it does in the dog, from habitual constipation.

The internal herniæ owe their existence to a congenital disposition. Orth (Lehrb, d. spec. pathol. Anat. I. p. 872) enumerates the following localities in which a hernia can take place:

Bursa omentatis.—It is a large peritoneal pocket, which is connected with the main peritoneal cavity through the foramen Monroei between the lig. hepato-duodenale and duodeno-renale, at least during childhood.

Fossa duodeno-jejunalis.—It is located in the beginning of the mesentery, is open superiorly, is adjacent to the vertebral column, sometimes all the way down to the promontory. Small intestine only, but almost all of it, can protrude through it.

Fossa subcæcalis.—It is on the median side of the cæcum and is formed by a peritoneal fold extending from promontory to cæcum.

Fossa intersigmoidea, on the inferior aspect of the mesocolon of the flexura iliaca.

The hernia formed by the locking up of intestinal convolutions in any one of the three last named fossæ is always retroperitoneal.

Small pockets, facilitating the origin of internal herniæ, are also found in the fossa ischiadica. Besides, Klebs describes a congenital hernial sac which exists in the plica vesicalis posterior, a semilunar duplication stretching from the posterior wall of the urinary bladder in the direction of the sacro-iliac articulation.

Diaphragmatic Hernia in the newly born always takes place in the left half of the diaphragm. Part of the intestines protrude into the thoracic cavity; how large a part, or whether ever the stomach participates in the change of position, depends on the size of the aperture and the mobility of the abdominal contents. As a rule the mesocolon and mesentery are but short in the newly born. In a case of Ahlfeld the newly born screamed immediately and loud, became cyanotic in the bath. The heart sounds were audible on the left side, were slow, the attempt at relieving the cyanosis (catheterisation of the larynx, etc.,) failed; soon the heart sounds were heard in the median line, then on the right side, and the apex beat in the right axilla. Tympanitic percussion sound extended all over the left side of the thorax. Death after 1½ hours.

There was evidently but a small opening in the diaphragm, and a moderate amount of mobility of the abdominal contents. In a case of mine the baby cried lustily once or twice while passing out of the vagina, became cyanotic at once, gasped a number of times, and was dead after a few minutes. There was a large

aperture, the left lung but a rudiment and the whole left side of the thorax was filled with part of stomach and intestines. In another case (Dr. Molony's) the baby lasted some days. We made the diagnosis by the cyanosis, the tympanitic percussion sound on the left, the displacement of the heart to the right, and the violent, croup-like, recessions—with every inspiration—of the præcordial region.

INFLAMMATION OF THE RECTUM—PROKITIS.

Catarrh and inflammation of the rectum are not very rare, though genuine uncomplicated inflammation is not found very frequently. Now and then we see it in connection with the pressure produced by obstinate constipation, occasionally by foreign bodies, and it may result in ulcers, or fibrous hyperplasia, or polypoid excrescences.

The surface is then covered with a muco-purulent secretion. The surrounding cellular tissue is very frequently also the seat of infiltration and hyperplasia, for the larger part of the rectum is not covered by peritoneum.

In this way a peri-proktitis is developed, which is apt to result in abscesses. Such an abscess gives rise either to incomplete (internal or external), or to complete fistula.

Not always, however, is peri-proktitis the result of a proktitis. Sometimes it will be due to pyæmia, sepsis, or severe cases of typhoid fever.

DYSENTERY.

It is found sporadic, endemic, and epidemic. It occurs mostly in the latter weeks of summer and in the early part of the autumn, and in warm, moist weather. It is certainly contagious, and it may be transmitted by soiled clothing, towels or water-closets. Whether drinking water, raw fruit, and uncooked substances in general carry the contagion, is not absolutely proven.

Dysenteric inflammation of the rectum varies in its degree of intensity and its extension. Sometimes it extends over the whole surface of the colon into the small intestine.

The affection may be of a catarrhal, follicular or diphtheritic nature. There is always swelling and local hyperæmia, and a secretion of mucus, pus, and blood. There is necrosis of the tissue, which breaks down and forms small or large abscesses and ulcerations.

The different forms will change into each other and show different degrees of severity. It is sometimes found on the elevations of the mucous membrane only, and sometimes there are changes all the way down to complete necrosis of the tissues with perforation.

As a rule, the affection is more uniform in children, who form the large majority of cases under observation. Still, the process will extend to the mus-

cular layer and to the serosa, both of which may become thickened and œdematous. The lymph follicles will become affected and may ulcerate. Loss of substance is very frequent. The mucous membrane will become undermined, and large portions will be destroyed. Thus the ulcers will sometimes be small and now and then very large indeed.

When necrosis takes place, there may be atrophy of the mucous membrane with local or general cicatrization, with loss of the glands, sometimes the formation of cysts, developed from the remains of glands.

The mesenteric glands are, as a rule, affected. In the beginning of the disease they are swollen and hyperæmic; later on swollen and hyperplastic. The spleen, in acute cases, is generally swollen, soft, and dark colored. The kidneys are in the first stage of the inflammation with albuminous urine. The lungs are congested; sometimes inflamed. The liver is now and then the seat of abscesses.

Symptoms.—There are cases which begin with very little fever, and mild symptoms in general, in which tenesmus is intermittent or is absent altogether, and there are some in which there is very little pain.

But the largest number behave differently, there is generally fever, sometimes to such a degree as to result in convulsions. There is a great deal of pain in the left hypochondrium; much thirst; the tongue and lips are dry; straining, and frequent passages which

contain only small quantities of fæces, and more mucus of the sago character.

The passages are not very offensive in the beginning, are alkaline, but occur from ten to forty or more times daily. Soon they contain pus, immense numbers of micro-organisms, of the same kind as are found in normal fæcal evacuations. The relief afforded by an evacuation is but temporary, and the movements follow each other with great frequency.

The abdomen which was not very much inflated in the beginning, now begins to swell, tenesmus is constant, pain is severe, and blood appears in the stools.

Diphtheritic deposits and broken down mucous membrane will follow. The children will exhibit the expression of intense suffering; will emaciate very rapidly; lie apathetic. The temperature at that time will fall sometimes below the normal. The heart becomes feeble, and in consequence dyspnœa will appear, also cough and pulmonary atelectasis. The anus will be excoriated. The sphincter ani will be softened and paralyzed, and thus a prolapse, sometimes of a large portion of the rectum, will take place to such an extent that extensive ulceration becomes visible. When this condition is reached the children are very apt to die.

During the whole sickness there is but little secretion of urine, which has a dark color, and is albuminous.

Recovery, as a rule, is very slow, particularly as the complications and consecutive diseases are very numerous. The lungs and the kidneys are in a condition of congestion or inflammation. The spleen is enlarged, and scurvy may be observed. Peritonitis will take place more readily in extensive dysentery than in acute enteritis. Perforation will, not infrequently, be the result of deep ulceration. Pyæmia may follow and suppurative processes. Abscesses of the liver are not very infrequent in severe epidemics. In full convalescence, even after apparent recovery, paralysis of the lower extremities may appear.

Thus the prognosis, while it is favorable enough in very mild catarrhal cases, is always doubtful, and in the protracted and diphtheritic cases it is bad.

Treatment.—It is always best to empty the bowels first. Castor oil will suffice. A dose of calomel, 2 to 10 grains, according to age of the child, will do well. Where there is tendency to vomiting it is not necessary that the calomel be swallowed. Dry calomel placed upon the tongue will there be changed by the liquids of the mouth into an albuminate and be absorbed then and there with favorable results.

Where the pain is very severe in the left hypochondrium and the child is vigorous, an ice-bladder is to be applied for a short time; anæmic children do not bear it. In them, once for all, warm applications are preferable. Warm injections must be given very frequently for the purpose of washing out the rectum

and that part of the colon which can be reached. Opium may be added to the fluid injected. Altogether, opium is tolerated better in this form of rectal inflammation than in any other form of inflammation of the bowels, similar to what is known of its use in peritonitis. Thus a child of two or three years, may receive the equivalent of $\frac{1}{4}$ of a grain of opium in a very warm injection, a number of times daily. A two-third per cent. solution of salt water is preferable to pure water. A saturated solution of boracic acid, or boracic acid from one to two parts in a hundred of warm water, is mild and will act as an anti-fermentative. It need not be feared that much absorption of opium or boracic acid will take place. For the inflamed and ulcerated condition of the mucous membrane does not permit it to occur. Where the introduction of the syringe is very painful, it will be well to use a small quantity of cocaine, in solution of the strength of from 5 to 8 per cent.; where the tenesmus is very severe, small pieces of ice may be introduced into the rectum repeatedly. Where prolapse of the rectum exists, I have often applied a rather concentrated solution of morphine on the inflamed ulcers and prolapsed portion; also have used a strong solution of cocaine and applied it in the same way.

The treatment of acute dysentery requires opium, as stated above, in larger doses than are usually given in diseases of infancy and childhood. A child of two years of age may safely take $\frac{1}{20}$ of a grain of

opium every two hours, with four to six grains of sub-carbonate or subnitrate of bismuth. The amount of food must be very small. It must consist of boiled milk, with or without mucilaginous or farinaceous admixture. Stimulants must not be given in the beginning. Absolutely nothing that is solid, and surely nothing which is cold.

Chronic dysentery has been spoken of under the head of chronic intestinal ulcers.

POLYPUS OF THE RECTUM.

Polypi of the rectum are tumors of the size of a pea up to that of a cherry or hazelnut, or more. They are single or numerous. In one patient, besides one of large, and a few of smaller size, I met with two dozen of quite small ones, of the size of a French pea, or less. They are either quite soft, or more frequently of greater consistency, composed mostly of cells or cellular tissue, quite vascular, contain often a harder adenomatous nucleus, and a Lieberkuhn gland imbedded in them. They are either pedunculated or sessile, on a broad base. St. Germain is in error, when he thinks they are all pedunculated. They are sometimes found between the two sphincters, mostly above and near the inner sphincter, not infrequently, however, all over the middle portion of the rectum, and sometimes quite near the so-called third sphincter. They were first described by Stoltz, in 1831 (*Jour. f. Kind.*, xxxiv, p. 393). One of the latest writers on diseases of children, Eustace Smith, says they are rare in children under ten years of age, Bokai found them 25 times in 65,970 patients, that is once in 2,600. In my clinic, amongst 500 patients; I see from one to three cases annually; during the thirty years of my former family practice, and also in the course of the last few years, I met with the same number annually, most of them being office patients presented for some of the prominent or threatening symptoms con-

nected with the ailment. Thus, I feel certain, that I meet with three or four cases every year, and have observed and treated about one hundred cases altogether. The children were mostly from one to seven years old, the majority between two and five. A few were less than a year old. Many of them looked pale and puny, others robust and vigorous. Amongst the symptoms are: irregular defecation; in some constipation, in others diarrhœa, occasionally in alternation, sometimes colic, discharge of mucus, tenesmus. (I may say, that these are the cases in which the polypus is very near the internal sphincter, or between the two sphincters.) A groove in the fæces (this is a rare symptom in children because in most cases the fæces are not hard) the appearance in or outside the anus, during a movement from the bowels, of a red body which rarely remains outside, and is mostly drawn into the rectum after defecation has been completed, and repeated hemorrhages. These furnish a teaspoonful, more or less, of clear, unmixed blood; it is discharged alone by itself, or with fæces. In the latter case it hardly ever mixes with the fæces, but lies on top of them like hemorrhoidal blood. This repeated hemorrhage is almost conclusive evidence of polypus in the rectum. For but once in my life have I seen blood coming from a varicosity round the anus, and never have I felt the temptation to diagnosticate premature menstruation, as has been done, because there was blood in the

chamber. When the blood is seen as described, the diagnosis is best made certain by the examination of the rectum. The sphincter and rectum, as long as they are normally developed, admit readily the index finger, and in most cases, but by no means in all, the presence of a polypus is made out quite easily.

Polypus is found together with rectal catarrh. It has therefore been assumed to be the result of chronic catarrh. Why that should be so, I do not perceive. When there is a nasal polypus and catarrh, the former is not taken to be the result of the latter; on the contrary, the latter may be the result of the former; particularly is that probable in the rectum, where most polypi have pedicles, at least after a certain time, which allow of a great moveability, thereby irritating the neighborhood. The pedicles are sometimes quite long and thin, sometimes to such an extent as to allow of their breaking spontaneously, thus facilitating its unperceived removal.

Grave symptoms may be a thorough anæmia, from repeated hemorrhages, or occasional nervous symptoms. Demme observed eclampsia in a five year old boy, which never returned after the removal of the growth.

The treatment has consisted with some, in the employment of the cold, or the galvanocaustic snare, or evulsion by means of pincers, or with the fingers. The growth is sometimes rubbed off, the pedicle offering but little resistance, or it can be rolled out into and

through the anus; there a ligature may be applied, or it may be caught in pincers, and the whole undergo torsion and evulsion. I have never hesitated to break the pedicle with my finger inside, and roll out the growth. •The bleeding has been but very trifling, but I ought to add, that some authors have seen hemorrhages, and therefore advise the ligature of the pedicle before the polypus is torn off or cut away. When it cannot be found it is necessary to wait for the next passage which will roll the polypus out. Sessile polypi may not be found easily, but they do not give rise to very urgent symptoms. The astringent injections which are to remove them, must be mild; solutions of 1 per cent. of alum, repeated often, will be found sufficient. I know of many cases in which sessile papillomata would thus gradually shrink.

PROLAPSE OF THE RECTUM.

Etiology.—Prolapse of the anus and rectum is the consequence of catarrhal and inflammatory irritation and softening. It will follow chronic catarrh and dysentery. It is produced by debility of the sphincter, which is often congenital, sometimes the result of neighboring diseases; also due to drastic purgatives, or constipation with the incidental straining. Such straining resulting in prolapsus, is also produced by the presence of polypus or worms in the rectum, by stone and catarrh of the bladder, and phimosis. A predisposition arises from the peculiar shape of the rectum in the young. It is straighter, inasmuch as the sacrum is not scooped out as it is in the adult.

The rectum is aptly divided into three parts. The upper part extends to the insertion of the peritoneum; the lower division consists of the sphincter with its strong circular fibres; and between these two is the third or middle portion of the rectum not covered by peritoneum but imbedded in large masses of connective tissue,

Prolapsus of the rectum is not always uniform. It is not always the entire mass of the rectum which protrudes, but only one side of it, just as prolapse of the vagina may be only partial.

The condition can be easily recognized. Spontaneously or after defecation, a soft, red, bloody, or

purple mass will make its appearance, and return after defecation spontaneously, or remain outside and is easily replaced. The secretion of the surface is mucous, sometimes bloody. Most of the cases present the prolapsus like a ball, and when they are large will be elongated like a sausage. There is no aperture in most of the swellings. When there is, we have to deal with a more severe form, a real invagination of the rectum.

When the sphincter is very flabby and semi-paralyzed, gangrene will seldom occur. When, however, the sphincter is still vigorous, and the case is one of invagination, partial or total gangrene may take place, for the same reason that gangrene will appear in every intussusception higher up, when the intestine is doubled upon itself.

Treatment.—Temporary reduction of the prolapsus is readily accomplished, particularly in such cases as those in which the sphincter is feeble, but the intestine will come down again. Attention must be paid to defecation. The children must not be allowed to strain. Thus the chamber must be placed in such a position, raised to such an extent, that the feet cannot touch the floor.

Hippocrates makes the following remark on this subject. "In children suffering from stone, and protracted genuine dysentery, the rectum is apt to be protruded. It should be pressed in with a soft sponge, and touched with a snail. Then the patient should

have his hands tied, and be suspended a short time, and thus the rectum will slip in. If it comes down again, a band should be placed around the loins; a bandage must be attached to this, and the rectum, after being moistened with a decoction of lotos, be replaced with a soft sponge. Also the intestine must be washed with this decoction and the bandage carried up between the legs to the umbilicus. During defecation the baby must sit with extended legs upon the feet of the mother, its body leaning against her knees."

Many appliances have been devised to retain the rectum inside. Adhesive plaster has been used as best it could, and a number of instruments have been invented for the purpose of retaining the rectum in position, while leaving an opening for the passage of the fæces. They have been made of hard rubber, lead and other materials.

Others have used a tampon, and some a compress to hold the nates together; but a tampon will certainly dilate the paralyzed sphincter more than it was before.

Curling confines his efforts to compressing the nates.

The main attention must be given to the treatment of the constipation, or the diarrhœa, the local catarrh, the rectal worms, the presence of polypi, the presence of stone in the bladder and phimosis, and all causes of straining and prolapse which have been enumerated above.

But there are direct indications which can be ful-

filled. Astringents have been used locally in the form of injections; alum and tannin principally, in solutions of one or two per cent. Ice has been applied directly, and ice-water injections can be used with advantage three or four times a day in small quantities, half an ounce to an ounce.

One enema must be given daily for the purpose of emptying the colon and avoiding the possible straining.

In most cases there is considerable swelling, sometimes real hypertrophy of the mucous membrane and of all the tissues. Then the prolapsus must be treated for the purpose of reducing its size. A part of the hypertrophied tissues has been excised, as is now being done in the vagina, either by the knife or the ecraseur. Caustics have been used. Nitrate of silver, in substance, to be carefully neutralized by chloride of sodium in solution, immediately after the application. Concentrated nitric acid has been employed for the purpose of destroying some of the superfluous tissue. The best remedy, however, for this purpose is the actual cautery. It should be applied either in long welts or stripes, or at half a dozen or a dozen points. It matters not whether the galvanocautery, or Paquelin's thermo-cautery, or the common actual cautery is used.

For the purpose of strengthening the sphincter, I have used frequently, for dozens of years, an ointment consisting of extract of *nux vomica*, one part, in

ten or fifteen parts of fat, to be applied to the lower part of the rectum from three to five times a day, or every time the bowel protrudes. The internal administration of strychnia is of very little avail; but that of ergot is serviceable. The subcutaneous injection of strychnia (sulphate gr. $\frac{1}{60}$ to $\frac{1}{30}$, dissolved in water, once daily) in the neighborhood of the sphincter, will be beneficial, particularly when supported by the action of the interrupted electric current, which may be applied for a few minutes once or twice every day.

FISSURE OF THE ANUS.

Fissure is reported to be a rare disease in infants and children. Bokai, Esmarch, and St. Germain in his recent work on the surgery of childhood, are agreed on that point. Daniel Moliere in his book on the diseases of the rectum, p. 155, expresses the same opinion, reporting but a slim literature on the subject, and quoting Ducloz, Allingham and Miller as his authority.

A. B. Kelsey in his "Diseases of the Rectum and Anus," N. Y., 1884, p. 267, has but a brief note on the occurrence of fissure in children. In it he refers only to Kjellberg, who emphasizes the fact that it is much more frequent than is generally assumed. Kjellberg's figures are as follows: 9098 children were presented in the Dispensary of Stockholm; in 128 there was fissure of the anus; 60 of the patients were boys, 68 girls; the majority were less than a year old, 73 less than four months. Thus, only Kjellberg claims that fissure is frequently found in the first year of life..

When the nates are gently parted, fissure is not visible, or but rarely so. Pulling harder upon the anus, to the right or left, it becomes perceptible as a narrow cut, red and clean, or sometimes grayish, and ulcerated, one-half, two or even five lines in length. Very seldom does it extend beyond the sphincter. Handling it as described a little blood may ooze out,

but there is never much loss of blood. The slightest touch is exceedingly painful. The surrounding skin is wholly normal, and the anus itself on anything but a very close inspection looks so healthy that the fissure is very often overlooked altogether. On examination however, not infrequently a contraction of the neighboring part takes place. It is partly voluntary, partly spasmodic. Thus, while the two, that is, fissure and contraction, are frequently seen together, it must be borne in mind that a fissure may occur without the contraction, and *vice versa* a dynamic contraction without a fissure.

There is a milder type of fissure which is not confined to the sphincter part of the anus. On a surface near the anus, more or less hyperæmic, there are slight erosions, and ulcerations, with superficial epidermic and cutaneous cuts. They may be the result of the rhagades of congenital or acquired syphilis, or of local erythema and exanthema, of vulvo-vaginitis, of eczema or herpes. Other causes, particularly of the more severe form, are foreign bodies, such as stones passing and injuring the sphincter. Constipation such as depends on the exaggerated length of the sigmoid flexure is apt to produce it. So are other causes of constipation, as for instance improper diet, and the congenital narrowness of the rectum. A somewhat different form depends on the congenital contraction of the sphincter; in this case the rectum becomes dilated above, feces accumulate and become exsic-

cated, and their final passage results in both pain and injury. When once established, the fissure remains, the alternating contraction and expansion, and the contact with feces renders recovery impossible. But it cannot be said too often, that it is sometimes very difficult to discover it, and that whosoever means to find, must have learned how to look for it. As a rule, it is found posteriorly in the median line.

The pain at defecation is very intense. Thus the patient has a mortal fear of moving his bowels. Voluntary constipation is the uniform result. It makes the case worse, screaming attends every evacuation, which is sometimes tinged with a trace of blood. The pain may last hours after the act, slight pressure on the parts is also painful, thus a peculiar expression of anguish and exhaustion may distort the haggard-like face. The results of the voluntary (and partly involuntary, through the reflex contraction of the sphincter) constipation will soon show itself, such as tympanites, gastric and umbilical pain, indigestion, sleeplessness, and cerebral irritation. I well remember the case of a little boy of two years whom I knew some ten years ago, whose pain did not return after a single forcible dilatation of the sphincters, and whose emaciation and anæmia improved from that very hour, not to return.

The morbid symptoms do not belong to the intestinal tract alone. Spasm of the neck of the bladder is quite frequent, and may give the impression of calculus of the bladder. Frequently have I had op-

portunities of emphasizing the fact that many of the emaciating colics of infants do not belong to the intestine—where, it is true, most of them are located—but that dysuria on the basis of renal calculi is not rarely the cause of the screaming spells lasting half and whole hours. Now, some of them, though attended with dysuria, have no primary seat in the urinary organs, but are due to fissure of the anus, which will explain the case when looked for and discovered.

Not in all cases, however, is there dysuria. Incontinence may take its place, but then it is an incontinence not of the usual paralytic character, but will appear in small quantities, and with more or less tenesmus.

In some infants and small children the local symptoms are less prominent. They are presented with the following history: They have not been well for some time, are not thriving, emaciate somewhat, cry a good deal, are restless for hours in bed, do not care to be taken up, scream quite suddenly, have frequently stools of normal or somewhat hard consistency, small in bulk, no diarrhœa, and cry while they have a movement. When you gather the fæces of the many evacuations, they are about the normal daily quantity or less. The children are fretful, eat but indifferently, and sleep interruptedly. Of such patients many had a fissure, and I have seen a goodly number of that class.

Another child was brought to this city from one of the large cities of the West by her father, himself a physician. She was five years old, had not enjoyed a well day for years. She had frequent stools, part of which were attended with excruciating pains. Many, however, were quite easy, a great many were bloody. On closer examination of the history I learned that the painless evacuations consisted of clear blood only, a teaspoonful or more at a time. The feculent discharges were always painful, they were rather hard, and came away in lumps, which now and then were slightly streaked with blood. From these points I could make my diagnosis, I thought. The blood must come from the presence of a polypus, or polypi. The excruciating pain was likely to be the result of an anal fissure. I laid the child over the knees of the father, found a median posterior fissure, introduced the index finger high up into the rectum, found a polypus of the size of a large cherry, pulled it out and tore it off; introduced the index finger again and also that of the left hand, dilated until I felt a slight grating sensation, and withdrew them. A few teaspoonfuls of blood and plenty of feces followed. The whole procedure took no more than two minutes. During that day there were a few more feculent discharges with but little blood, with less pain than the child had endured for years. The next day she felt nearly well, and two days, and every day afterward she had no pain or any ailment of any kind.

This complication of polypus and fissure is not frequent; I have seen but few of its kind. But fissures are frequent indeed, and not a rare cause of great suffering. The severe form is not often met with during the first year of life, but in the following years is more common. If I say that of the severest type I meet with half a dozen annually, I underrate rather than overestimate.

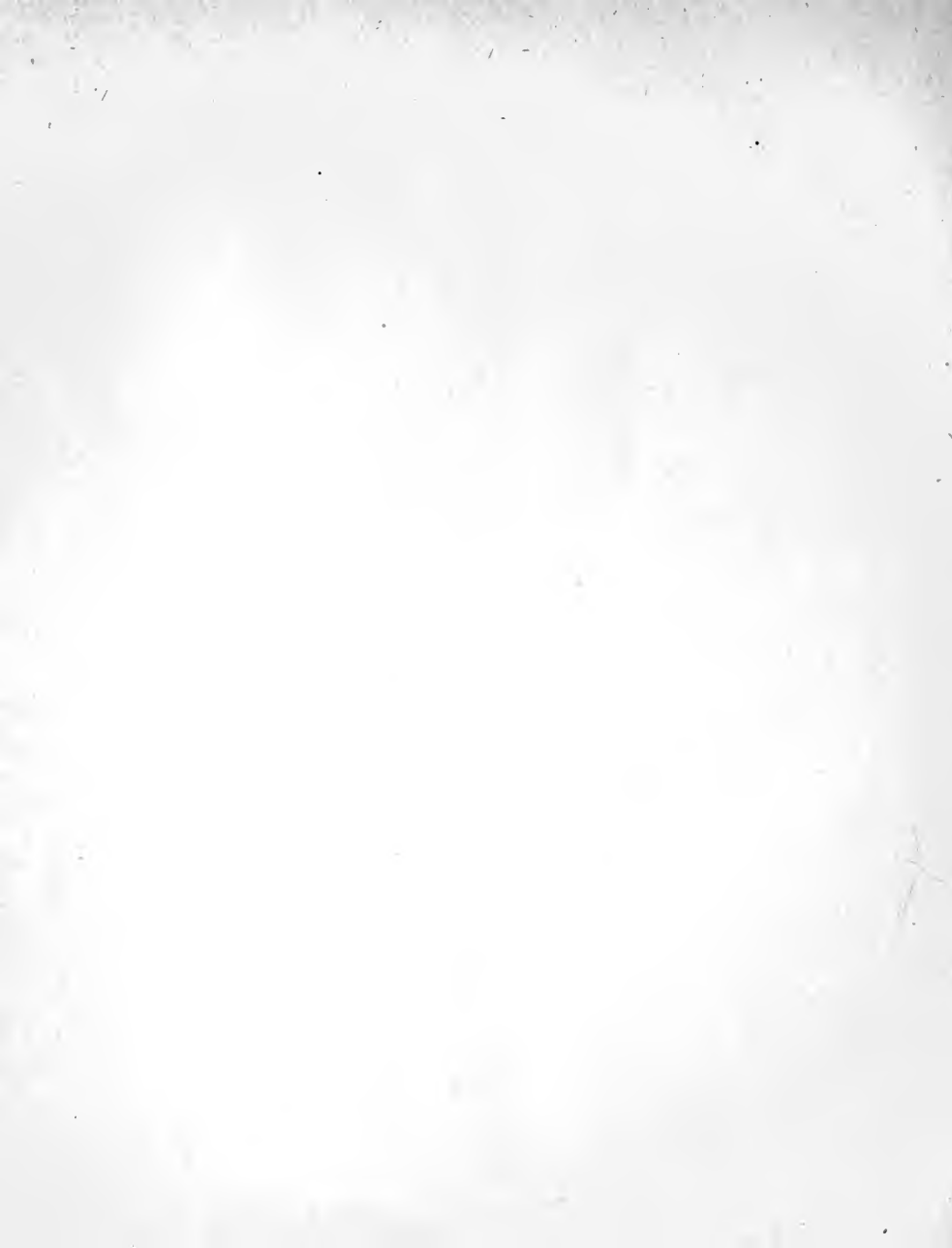
The treatment has consisted in the relief of occasional diarrhœa, and that of the more frequent constipation, by enemata and mild purgatives, in the application of astringents, such as lead, copper, zinc or alum; or of caustics, such as nitrate of silver by Esmarch, or of nitric acid. This treatment is painful and tedious. Boyer advised incision through the whole of the sphincters. The open wound may bleed and give rise to ulceration, or sepsis. The proper treatment consists in dilatation of the sphincters. Josseline directs it to be gradual, thereby protracting uncertainty and pain. The best and speediest method is forcible instantaneous dilatation without anæsthesia. The operation takes so little time that it is hardly required except in very puny or convulsive infants or children. The introduction of two fingers of the same hand is rarely sufficient, three or four do better. The easiest way is to use the two index fingers; a sufficient dilatation is recognized by the distinct sensation that the muscular fibres have given way. The external wound is trifling, and but superficial.

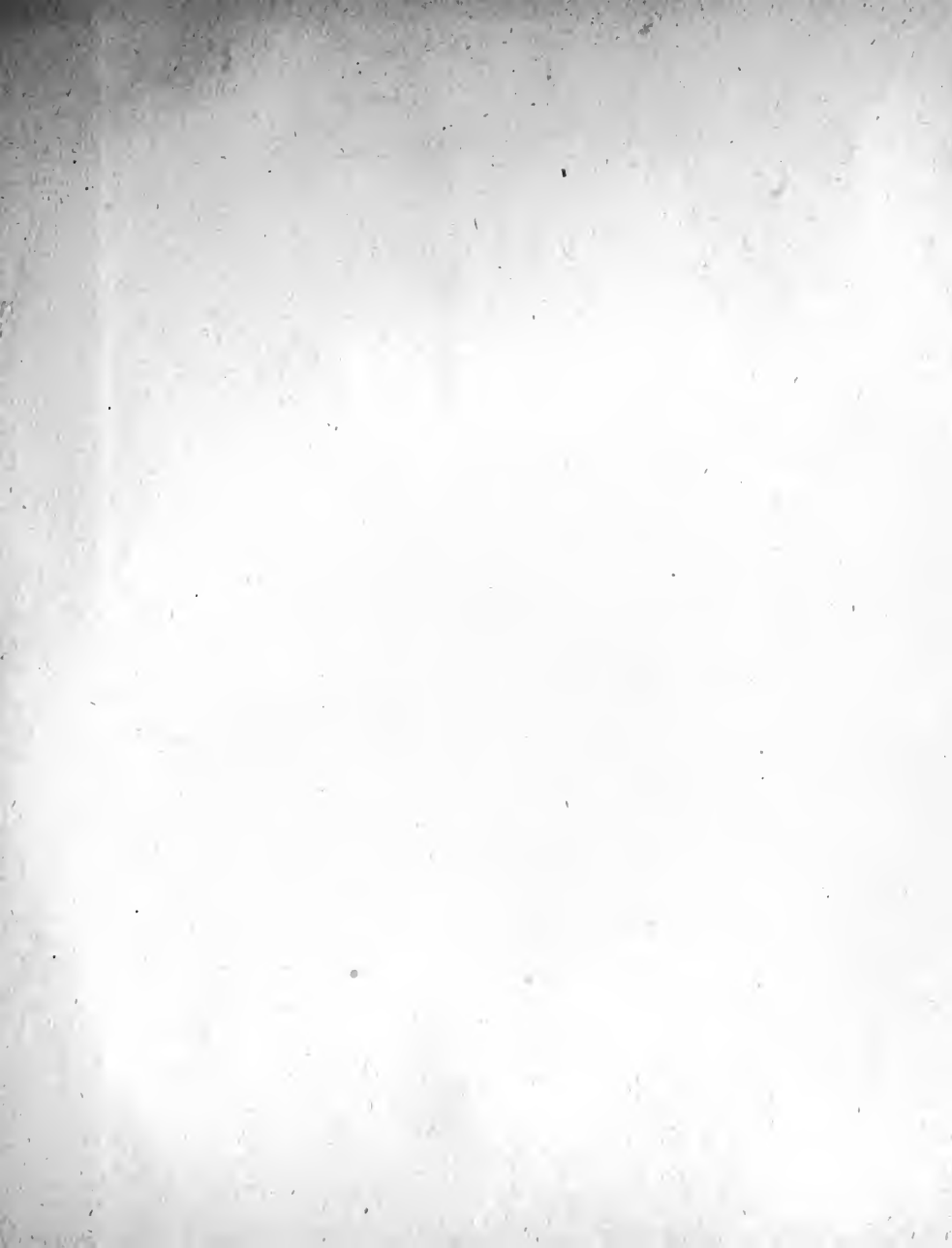
In justice to a deserved author, I quote from Allingham's: "Diseases of the Rectum," Phil., 1882, Ch. XV. He says, "In children and young persons, unless a polypus implicates the fissure, I think it is almost always curable without operation. In children suffering from hereditary syphilis, numerous small tracks around the anus are common, and they cause much pain. Mercurial applications and extreme cleanliness soon cure them, but they will return from time to time unless antiseptic medicines be taken for a lengthened period."

From this it appears that he has seen but the milder and more external forms to which I have alluded above.

Another mild form—at least as far as the fissure is concerned—is one which I, personally, have met with but very seldom, but which, according to my friends Dr. J. C. Perry and Dr. J. Byrne, does not appear to be very rare. In this class of cases the fissure is complicated with a loose, dilated and very dilatable anus. The symptoms belonging to this class are not of the severe kind described by me, and the application of the lunar caustic, or Boyer's superficial incision is sufficient for a cure.









MCh
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The intestinal diseases of infancy and
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